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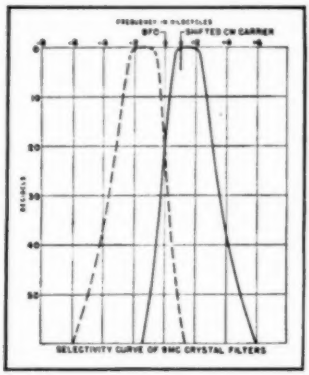

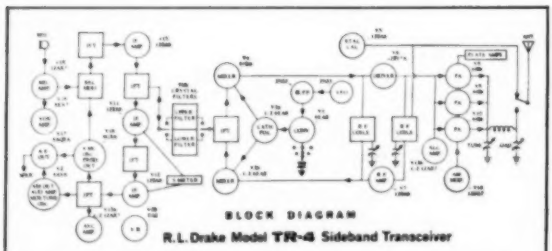

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73

Magazine

Wayne Green W2NSD/1
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Assistant Editor

June, 1965

Vol. XXXII, No. 1

A VFO with FSK Provisions W6TKA 18
A stable VFO for the SSB-RTTY man.

Shoulder Strap Portable K1CLL 22
An easy-to-build 6 meter rig for portable operation.

Superimposing 6 meters on your Tribander W4API 25
The ideal match for a transmitting converter.

The Waters Codax WA2TDH 26
A very fine all-purpose electronic key.

73 Tests the Henry 2K Linear W2NSD/1 28
An Imperial Gallon.

Gus: Part II W4BPD 30
In which a country boy from South Carolina finds true happiness . . .

Interlaced Sync Generator for Ham TV ... W1JJL 34
A reply to the anguished cries for more TV information.

Fixed or Mobile WA9AFI 36
Some notes on hamming for the handicappd.

A Compact DC-to-DC Converter W6GXN 38
Especially useful for that one tube in a transistor rig.

Oscar Round-up ..... KØCER 40
Who was worked and who was heard.

A Surplus Sleeper W9SLM 44
Here's one you may have overlooked.

The Kitchen Heat Sink ..... WØCGQ 46
We **try** to get the best titles . . .

Converting the R-508/ARC W4WKM 48
A modern surplus receiver for 118-148 mc.

Using the 416B on 220 mc W5AJG 52
In the CG-50ABM.

High Power with the ART-13 ..... K4PFK 56
Souping up an old reliable.

Converting the ARC-4 ..... W4WKM 60
A versatile 2 meter transceiver with little work.

The CV-253/ALR Converter W1KSZ 66
A useful receiver for 38 to 1000 mc.

220 mc Converter from the ARC-27 .... W5AJG 68
Tunable to get rid of the trash and birdies.

Adding GDO Features to the TS47A/APR W5AJG 74
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De W2NSD/1	2	VHF	88
Letters	41, 121	Semiconductors	88
Surplus Frequencies	45	Caveat Emptor	122
New Products	51, 90	Propagation	126

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de W2NSD/1

never say die

Docket 15928 . . . Incentive Licensing?

Let's save the fury and hysteria for later . . . first let's take a close look at the proposals. I don't know about you, but I have gone through a nasty time with this one . . . indignation, frustration, apathy. Grab the panic handle and read on.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C. 20554

In the Matter of
Amendment of the Amateur Radio
Service Rules to provide for
Incentive licensing and
Distinctive Call Signs

DOCKET NO. 15928
RM-378, 455, 470, 474
480, 481, 499, 516,
517, 538, 577

NOTICE OF PROPOSED RULE MAKING

By the Commission: Commissioner Loevinger absent.

1. The Commission has under consideration nine petitions proposing, to varying degrees, that special privileges be given to the holders of Amateur Extra Class licenses as an incentive for licensees to obtain this highest class of Amateur operator authorization. Many of the petitioners additionally propose that, as a stepping-stone to the Amateur Extra license, another higher class of operator license be created which would also carry special privileges as an inducement to its attainment. A number of the petitioners recommend changes in the procedure for assignment of station call signs to correspond to a new license structure.

Since we shall consider the call sign problem in this connection, we will also consider RM-470 and RM-474, petitions which are solely concerned with the call sign assignment procedures. The attached appendix lists the petitioners.

2. To support their proposals, the petitioners essentially contend that there is a need for a general improvement and "up-grading" of operations in the Amateur Radio Service which can best be fulfilled by establishing an "incentive licensing" program. They maintain that amateur operators will thereby be encouraged to self-improvement by qualifying for higher classes of licenses. The chief proponent of these views is the American Radio Relay League (ARRL), a national Amateur radio organization with approximately 85,000 members. In its petition, RM-499, the ARRL states:

"A most significant trend has developed in the last few years which has caused increasing concern to the League as to whether the basic purposes and objectives of the amateur radio service, particularly those relating to technical qualifications and proficiency, as set forth in subparagraphs (b), (c) and (d) of Section 12.0 [97.1] are being and may continue to be adequately achieved.

This trend has arisen from two developments, . . .

In 1951, the Commission after an extensive rule making proceeding in Docket No. 9295, adopted major changes in the amateur license structure. Both lower-level (Novice and Technician) and higher-level (Amateur Extra) classes were established with commensurate examination requirements. All frequency bands and all modes of operation were made available equally to the Amateur Extra, Advanced, General and Conditional Class. Although special privileges were contemplated by the Commission for the new Amateur Extra Class, none has yet been adopted. Thus, once an amateur has obtained his General or Conditional Class license he no longer has any practical or meaningful incentive to increase his technical knowledge and proficiency and earn a higher grade of license.

The second development contributing to the trend is the development and availability of highly complex and efficient manufactured equipment, particularly single sideband suppressed carrier (SSB) radiotelephone transmitters, receivers and transceivers. The design and construction of many equipments are so excellent and the operation is so simple that it no longer is necessary for an amateur using such equipment to have practical knowledge sufficient to construct his own equipment or to even fully understand the circuitry and theory of operation of the manufactured equipment. As a result, there has been little incentive for many amateurs, once licensed, to increase their technical knowledge and proficiency as contemplated by subsections (b), (c) and (d) of Section 12.0 [97.1] of the Commission's Rules."

3. A summary of the specific pertinent proposals in the petitions under consideration is as follows:

a. Six petitions (RM-455, 480, 499, 516, 517, 538) propose that the Advanced Class license, which has not been issued to new applicants since 1952, be again made available but as a new higher clas of authorization with special privileges. Some of the petitioners would "grandfather-in" the present holders of the old Advanced Class license (about 40,000). While the suggestions vary as to the type of examination which would be required for this new Advanced Class license, they generally contemplate a difficulty level somewhere between that of the examinations for the General and Amateur Extra Class licenses.

b. RM-577 advocates that there be both an "Extra Phone" and "Extra CW" license, both licenses to be issued to present holders of the Amateur Extra Class license. Other persons could then apply for either or both licenses, depending upon the type of operation desired.

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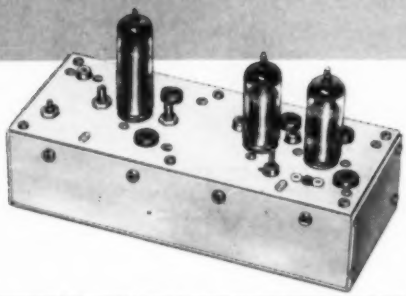

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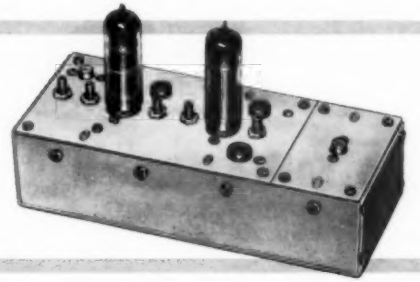

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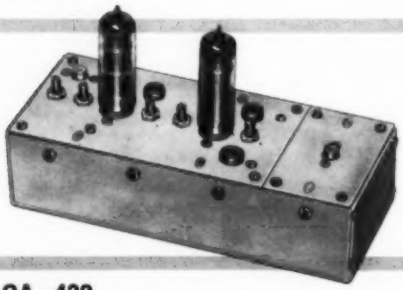

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The AOA multiplier / amplifier uses two 6360 tubes providing 6 to 8 watts output on 220 mc. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate: 250 vdc @ 150 ma.
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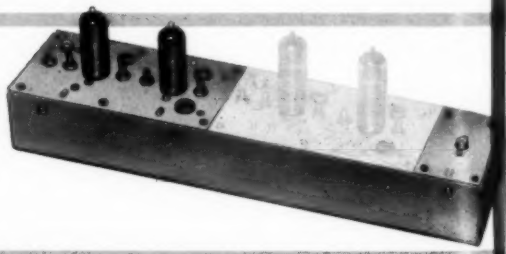

AOA - 420
MULTIPLIER / AMPLIFIER FOR 420 mc
The AOA-420 multiplier / amplifier uses two 6939 tubes providing 4 to 8 watts output on 420 mc. Requires AOA-57 plus AOA-144 for drive. Heater: 6.3 volts @ 1.2 amps. Plate: 220 vdc @ 130 ma.
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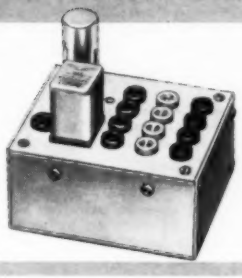

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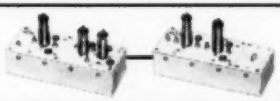
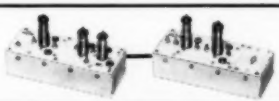
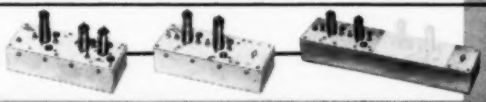
2 METERS	**144 mc**	**AOD-57 PLUS AOA-144**	
	220 mc	**AOD-57 PLUS AOA-220**	
	420 mc	**AOD-57 PLUS AOA-144 PLUS AOA-420**	

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c. With regard to the nature of the privileges for these higher classes of licenses, six petitions (RM-455, 480, 481, 499, 516, 517) propose the reservation of portions of high frequency (HF) telephone bands between 3.5 and 29.7 Mc/s. RM-455 would additionally reserve HF telegraphy segments for the Amateur Extra Class. RM-538 and 577 recommend reserved telephony and telegraphy sub-bands in all, or most, of the bands below 148 Mc/s for the Amateur Extra Class. Three petitions (RM-455, 499 and 516) would leave the width of the present HF telephony sub-bands unchanged but available only to Advanced and Extra-Class operators while three others (RM-481, 517, 577) would expand the width of the telephony bands but reserve only portions thereof to the Advanced and Extra Class. Two petitions (RM-481 and RM-577) recommend that the reserved telephony segments be restricted to single side band or suppressed carrier emissions. RM-499 and RM-516 propose a staggered timetable for implementation of the resevation of the telephony bands.

d. RM-378 proposes that two-letter station call signs (call signs with a single letter prefix and a double letter suffix) be issued to holders of the Amateur Extra Class license. A number of the other petitions also recommend new call sign assignment procedures which relate to the 'incentive licensing" program.

4. The proposals for an 'incentive licensing" program have generated the largest number of comments and the greatest controversy in an amateur rule-making matter in many years. Nearly all of these comments are in response to RM-499, the ARRL petition. A large number of persons, about equally divided, merely approved or opposed RM-499. Of those who gave reasons for their opposition, only a very few aparently felt that an 'incentive licensing" program was not desirable or was unnecessary. These persons either thought that amateur radio operations were presently satisfactory or that methods other than "incentive licensing," such as requiring an examination for license renewal, would cure any ills. Many objectors to the ARRL proposal stated that the reservation of frequency bands to higher class licensees to the extent advocated by the League would unduly encroach upon the operating privileges of the lower classes of licensees. They maintained that loss of these most desirable frequency bands would force licensees to acquire higher classes of licenses in order either to utilize their equipment or to enoy the most rewarding aspects of amateur radio operation.

Endorsement of the ARRL position was received from many persons of widely diversified interest in the Amateur Radio Service.

a. From a retired former Chief Signal Officer of the Army:

"During the early years of my military career (the 1930's) whenever an individual who possessed a radio amateur license came to my attention I did my utmost to have the individual assigned to communications work. His license spoke well of his technical understanding and intense interest. During the latter part of my career (the last decade or so) such has not been my feeling. The license has generally meant 'Here is another hobbyist—maybe he has it and maybe he doesn't.' The license has lost its stature; it appears to be anybody's, just for the asking . . ."

b. From the Bar Association Librarian of a large city:

"It does not disturb me that for a time I may be precluded from operating in certain bands until I have demonstrated that I am able to understand and therefore successfully negotiate more advanced requirements. May I say here that I do not believe the reliability of commercially produced equipment to be any excuse for ignorance in its operators.

I see every reason to believe that the amateur service would flourish under an incentive program. In this era of continuously pressed demands for increased competence in every area of activity, I cannot see how amateur radio can prosper if it adheres to the comfortable ways of yesterday."

c. From the president of a leading electronics manufacturing company:

"A decade ago when a licensed radio amateur applied to the company for employment, mere possession of a 'ham ticket' was sufficient guarantee that the hold was technically competent, could read a schematic, h the capability to learn, and was capable of mature grow in the industry. Many of today's leaders in the ele tronics field advanced along this very path. Now, a though the electronics industry is in chronic shorta of trained technicians and engineers, by and large, a plicants for these jobs are not coming from the ran of the radio amateur. Possession of a radio amate license does not now mean that the holder is technical qualified in any sense. On the contrary, the Personn Department of this Company has been continually di appointed with the quality, calibre and technical abili of holders of radio amateur licenses to such an exte that such individuals are subject to careful screenin before they are considered for employment."

d. From a college engineering and technology edu cator:

"As a college instructor, we automatically assume (and with good basis) that an engineering student wh was also a radio amateur, would be a highly capabl student willing and able to accept the loads and re sponsibilities of an engineering program. This idea t an even higher degree was present when the new stude possessed a license of one of the more advance classes . . .

In contrast, today we in education almost prefer n to have our students come to us with amateur radi licenses. Typically, today's ham is concerned wit contests and chatter and knows little or nothing theory and construction. His approach to study and la is hit-or-miss or the try-this-or-that approach. He ap pears never to have tried to understand the basis electronics to say nothing of his equipment itself. H has probably never wired anything more complex tha a cable or two and would not consider the modificatio or service of even his personal receiver. He simpl wouldn't know how and is not really interested in i beyond its function of reception."

e. From the Communications director of a state Civil Defense department:

"The . . . Division of Civil Defense values very highly the service rendered to our organization b amateur radio operators through the Radio Amateur Civil Emergency Service. Without this Service our emergency communications would be severely handicapped. The reservoir of trained technicians, available within the amateur radio service, is of immeasurable value to the success of our civil defense program in (the State).

With this thought in mind, it is felt that any attempt to up-grade the amateur service will ultimately result in a higher grade of trained personnel which may be called upon in time of national emergency. . . Therefore, I would like to recommend immediate adoption of the suggestions contained in their proposal, and further recommend a complete revision of the examination material with the view of increasing the scope of the examination as well as the degree of difficulty of the questions contained therein."

5. The Commission has carefully considered each of the subject petitions and the documents in response thereto in the light of its responsibilities under the Communications Act to regulate the use of the radio frequency spectrum in the public interest, convenience, and necessity. It is altogether clear that justification for the continued allocation to the Amateur Radio Service of a substantial portion of the spectrum in the face of incessant and important demands by other radio services can not be founded on anything other than a continuing movement of the Amateur Service toward the goals specified in Section 97.1 * of the Amateur Rules. It is the Com-

* "§97.1 Basis and purpose. The rules and regulations in this part are designed to provide an amateur radio service having a fundamental purpose as expressed in the following principles: (a) Recognition and *enhancement* of the value of the amateur service to the public as a voluntary noncommercial communications service, particularly with respect to providing emergency communications. (b) Continuation and *extension* of the amateur's proven ability to contribute to the advancement of the radio art. (c) Encouragement and *improvement* of the amateur radio service

mission's opinion that revision of the present license operating privilege structure is an appropriate and desirable step to take at this time to insure such progress and place a proper emphasis upon the quality of the service as well as upon its mere numerical growth and activity. Accordingly, we propose to revise our rules to provide for higher classes of licenses with special privileges as an incentive to the general "up-grading" of licensees. We propose, additionally, to revise the privileges and term of the Novice Class license, to modify a basis of eligibility for the Conditional Class license, and to provide for distinctive station call signs. These latter proposals are all considered to be consistent with, and necessary to, an incentive licensing program.

It has been suggested in some of the comments that, although there is a need for improvement of licensee knowledge and proficiency in the Amateur Radio Service, rule changes are not appropriate since the licensees should adopt their own program for improvement. While, of course, self-initiative by licensees is vital, we can not agree that Commission action is inappropriate. Section 97.1(c) of the rules clearly contemplates the improvement of the Amateur Radio Service through rules which provide for the advancement of skills in both the communication and technical phases of the radio art.

6. In consideration of the foregoing, the Commission proposes amendment of its Amateur Radio Service Rules as follows:

A—A new higher class of license to be designated the Amateur First Class license shall be created. Eligibility for this license shall be limited to an Advanced, General or Conditional Class licensee who has held such license for at least one year. Examinations for this license will be conducted at Commission Field Offices or examination points. Applicants will be required to pass a 16 word per minute code test and a written examination of a difficulty level between the General and Amateur Extra Class examinations.

B—Holders of either the Amateur Extra Class or the Amateur First Class license shall be exclusively entitled to utilize the frequency segments 3800-3850 kc/s, 7200-7225 kc/s, 14200-14235 kc/s, 21250-21300 kc/s, 50-50.1 Mc/s, and 144-144.5 Mc/s effective one year after adoption of these rule changes, and 3800-3900 kc/s, 7200-7250 kc/s, 14200-14275 kc/s, 21250-21350 kc/s, 50-50.25 Mc/s, and 144-145 Mc/s effective two years after adoption of these rule changes.

C—Holders of the Amateur Extra Class license shall be exclusively entitled to utilize the frequency segments 3500-3525 kc/s, 7000-7025 kc/s, 14000-14025 kc/s, and 21-21.025 Mc/s effective one year after adoption of these rule changes, and, 3500-3550 kc/s, 7000-7050 kc/s, 1400-14050 kc/s, and 21-21.050 Mc/s effective two years after the adoption of these rules changes.

D—The Advanced Class license shall no longer be renewed. Present holders of this license shall be issued the General Class license upon renewal. The basis for this proposal is that there no longer exists any valid distinction between the Advanced and General Class licenses as to the difficulty of the examination. Therefore, continued issuance of the Advanced Class license has become an unnecessary administrative burden and, under an incentive licensing program, would merely lead to confusion.

E—The Conditional Class license shall no longer be available to new applicants who claim eligibility solely by virtue of active duty in the military service. This proposal is consistent with the Commission's policy that, where feasible, applicants for higher classes of amateur licenses be examined by Commission personnel rather than by volunteer mail examiners. Of course, many military members will be able to establish their eligibility for the Conditional Class license under one of the other categories such as the distance basis or temporary overseas residence.

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through rules which provide for advancing skills in both the communication and technical phases of the art. (d) *Expansion* of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts. (e) Continuation and *extension* of the amateur's unique ability to enhance international good will."

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"World's Largest EXCLUSIVE Manufacturer of Towers; designers, engineers, and installers of complete communication tower systems."

F—New holders of the Novice Class license shall be given a two year non-renewable license term in lieu of the present one year non-renewable term. This will afford Novice Class licensees a more reasonable period for the development of skills necessary to advancement to the higher classes of licenses.

G—Effective one year after adoption of these rules, telephony privileges for the Novice Class licensees in the frequency segment 145-147 Mc/s shall be deleted. Deletion of this privilege is proposed because too many Novice Class licensees operate telephony equipment to the neglect of improvement of their telegraphy speed. One of the prime purposes of the Novice Class license is to prepare, through actual operating experience, for the higher classes of licenses which require increased code proficiency.

H—Each new amateur station shall be systematically assigned a distinctive call sign to denote the licensee's class of operator license.

This is necessary in order for our monitoring facilities to immediately determine whether a particular licensee is operating within the range of his privileges and whether a licensee is subject to re-examination of his qualifications.

The following schedule will be used for assignment of station call signs. Presently assigned call signs will be changed upon renewal or modification of the station license to conform with this schedule:

(1) Amateur Extra Class—the single letter prefix "W" and a double letter suffix, provided that the licensee submits evidence of having held an amateur station license issued by the United States Government prior to July 1, 1932 (e.g. W2AB); a double letter prefix beginning with the letter "W" and a double letter suffix (e.g. WA2AB); **

(2) Amateur First Class—the single letter prefix "K" and a double letter suffix, provided that the licensee submits evidence of having held an amateur station license issued by the United States Government prior to July 1, 1932 (e.g. K2AB); a double letter prefix beginning with the letter "K" and a double letter suffix (e.g. KA2AB);

(3) General (Advanced)—a single letter prefix and a three letter suffix (e.g. W2ABC);

(4) Conditional—the double letter prefix "WC" or "WD" and a three letter suffix (e.g. WC2ABC);

(5) Technician—the double letter prefix "WT" or "WU" and a three letter suffix (e.g. WT2ABC);

(6) Novice—the prefix KN and a three letter suffix (e.g. KN2ABC);

(7) The call signs of General (Advanced), Conditional or Technician Class licensees who currently hold a station call sign which has a single letter prefix and a double letter suffix will not be changed solely because of failure to qualify for an Amateur First or Extra Class license.

(8) Stations located in Alaska, Hawaii, Puerto Rico, and in United States possessions under Commission jurisdiction will be assigned special double letter prefixes to show their specific locations followed by a double or triple letter suffix which will, where feasible, indicate the class of operator license.

I—Assignment of station call signs shall be in accordance with the foregoing schedule with only the following exceptions:

(1) A specific unassigned call sign may be reassigned to a previous holder thereof provided that it is appropriate to the class of operator license currently held by the station licensee;

(2) A specific unassigned call sign may be assigned to an amateur organization in memoriam to a deceased member and former holder thereof provided that it is appropriate to the class of operator license currently held by the station trustee;

(3) A specific unassigned call sign may be temporarily assigned to a station connected with an event, or events, of general public interest provided that it is appropriate to the class of operator licens currently held by the station trustee or licensee.

7. It is the Commission's belief that these propose amendments reflect a realistic solution to the need for a immediate and effective incentive licensing program the Amateur Radio Service as advocated by most of th petitioners. To the extent that the particulars of any the petitions involved are at variance with these proposal they should be considered as having been denied. How ever, this does not preclude, and the Commission hereb encourages, the submission of new counter-suggestions f consideration. Comments are particularly invited as t (1) the utility and interest in continuing the Amateu Extra Class of license in the light of the proposal t establish an Amateur First Class license and the poss bility that the reserved frequencies associated with th Amateur Extra Class may not be fully occupied; (2) th width and the placement of the various reserved frequenc segments for each class of license in each band.

8. These proposed amendments are issued pursuant t the authority contained in Section 4(i) and 303 of th Communications Act of 1934, as amended.

9. Pursuant to applicable procedures set forth in Sectio 1.415 of the Commission's Rules, interested persons ma file comments on or before July 15, 1965, and reply com ments on or before July 30, 1965.

All relevant and timely comments will be considere by the Commission before final action is taken in thi proceeding. In reaching its decision, the Commission ma also take in account other relevant information before it in addition to the specific comments invited by this Notic 10. In accordance with Section 1.419 of the Commission' Rules and Regulations, an original and fourteen copie of all statements or comments shall be furnished th Commission.

FEDERAL COMMUNICATIONS COMMISSION

Ben F. Waple
Secretary

Attachment: Appendix
Adopted: March 31, 1965
Released: April 1, 1965

APPENDIX

PETITIONS INVOLVED IN THIS PROCEEDING

PETITION NO.	DATE FILED	PETITIONERS
378	November 5, 1962	Chester L. Smith Bedford, Massachusetts
455	June 5, 1963	Roy R. Cone Chicago, Illinois
470	August 9, 1963	Walter A. May, Jr., Simon Kahn, Stanford G. Houghton, Stephen M. Newmark Los Angeles, California
474	August 26, 1963	Alex S. Labounsky Oyster Bay, New York
480 and 481	September 11, 1963	Ellen W. Ackerman Panama City, Florida
499	October 3, 1963	American Radio Relay League Newington, Connecticut
516	October 28, 1963	George H. Goldstone Bloomfield Hills, Michigan
517	October 28, 1963	Lowell E. White Elmwood Park, Illinois
538	November 22, 1963	Leland W. Aurick, George S. Gadbois Columbia, Pennsylvania
577	March 3, 1964	Wayne Green Peterborough, New Hampshire

There are many good aspects to the docket . . . and some weak spots. The weak spots will probably draw criticism, while the good aspects may get overlooked in the fray.

** Consideration will also be given to the assignment of call signs having a two-letter prefix and a one-letter suffix (e.g., WA2B).

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the Stronger Mobile Antenna

With Waters new AUTO-MATCH, you'll get the signal strength **out** that's engineered **into** your modern, compact transceiver. Every precious DB of it! And AUTO-MATCH is built to endure with its stainless steel tapered radiator tip and tough aircraft aluminum mast. It operates on any band with a simple change of top-center loading coils. (Coils are sealed in protective, low-loss Epoxy.) AUTO-MATCH—the permanent solution to your mobile antenna problems!

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Coil 370-75	$15.95	Coil 370-11	$11.95
Coil 370-40	$14.95	Coil 370-10	$11.95

Waters

NEW CODAX ™ Automatic Keyer

CODAX — new rhythm-smooth **automatic keyer** by Waters — never anything like it! Feather-touch double paddle is factory-adjusted for precise gap and **tension. Spacing** and timing from 5 to 50 WPM is fully automatic. Battery powered all-solid state digital circuitry with **sealed** Reed Relay output for **block grid keying.** Also operates into mike jack to work VOX CW on upper or lower sideband. Unique audio circuit provides for monitoring and mixing incoming signals.

Model 361 ..... $92.50 (Less batteries)

Introducing .... Waters **CLIPREAMP™**

to increase your "talk power"

A solid state clipper-preamplifier, the brand new Waters CLIPREAMP will increase your intelligibility and talk-power up to 4 times when band conditions are tough! Self-powered and weighing but 6½ ounces, CLIPREAMP installs externally between microphone and transmitter in a matter of minutes. Front panel controls switch CLIPREAMP IN or OUT, OFF or ON, and permit Compression-Level adjustment to individual requirements. Input: 100K ohms; Output: 50K ohms; Voltage Gain: 10 DB nominal; Power: 9-volt battery.

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(Less battery)

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Novices

The docket proposes to extend the Novice license to two years and delete their two meter phone privileges.

It is a shame to pick on Novices this way . . . they are new and unorganized . . . even more so than the rest of us, and that is a pretty bad state of disorganization.

Two years? Why? What will this accomplish? First of all it will put the final judgment day far enough off so that most Novices may be able to get used to the operating they are permitted to do and forget about trying to get ready for the General Class license. One year doesn't seem very long and it makes you hop right to work . . . two years is a heck of a lot longer and I think it will be very bad for Novices. It certainly doesn't take two years . . . or even one full year . . . to pass the General license test.

Two meters. Since a certain percentge of the Novices will obviously be interested in getting a Technician license instead of a General, why keep them off this all too sparsely populated band in the interim. They can use their time on two meters to very good advantage getting practical VHF experience and applying it. When you consider that we have about 60,000 Techs and only 95,000 Generals you can see that a high percentage of Novices obviously will be heading for this license. Why stop them?

On the other hand, only a small percentage of the Novices do spend any great amount of time on two meters. Thus the removal of this privilege would not work any serious hardship on more than two or three per cent of the Novices.

Advanced Class

The bitterest pill of all has been spooned to the Advanced. Fellows with up to 50 years or more in ham radio are understandably furious with the ARRL for having precipitated this personal disaster on them. Their feeling about losing their privileges in half of the phone and active CW bands is about the same as a doctor might feel after being licensed for years and then finding that he has to go back to medical school again and learn the answers to all of the questions on the latest medical exam. His years of service and wealth of practical experience are worth nothing and he has to start over with the youngsters . . . back to school.

Some compare it to asking a lawyer with years of practice to go back to law school and prepare to pass the latest bar exams. The parallel is apt. The concept is revolutionary. The anger and frustration are monumental.

Technicians

Outside of being moved up on six meters a bit, most Techs won't be affected by this proposal. In my experience most Techs are quite satisfied with six and two meter operation and are little interested in the lower bands. They have made a good adjustment to the barrier we have placed between them and the rest of us because they have balked at our antique code requirements. Perhaps this is a lesson to all of us . . . perhaps we will all accept our new frequency assignments with as little upset as the Techs have accepted their limited existence.

Two Meters

When they set about hacking up two meters they are goring my own personal ox, to use Huntoon's snide phrase. Though I'm not terribly active there and haven't gone out after glory and records, I have been around the band since it started.

Two meters is not a healthy band. It has been suffering from Tech-split for many years now and the infection has held it back. The ARRL had the right idea when they petitioned for the Techs to get the entire band a couple years back. Though there are a lot of Techs on two meters, I know of very few who were incentived to get their General license so they could go to the low end of the band. All that dividing the band up accomplished was to give us two much weaker bands, one for Generals and one for Techs . . . with not much congress between.

Reserving the lower megacycle for First and Extra licensees would probably kill off the little colony on the low end and get everyone together above 145 . . . which would eventually qualify the lower megacycle disaster area for some other service than amateur. Right now there is a lot more activity above 145 than below in most areas of the country.

Six Meters

Though they don't say so specifically, it seems as if the docket will revoke the present CW band from 50.0 to 50.1 mc. This is just as well, as very little use has ever been made of this segment. This is what I said would happen back when they put it aside. I fought the change, but the ARRL overwhelmed me and it went in anyway. Their CW band up on two meters has had just as much use. Silly stuff. The ARRL, if you will remember, petitioned for it.

Six will be split up a lot the way two is today, with the bottom 250 kc for Extra and First. I predict that if this is done that the 250 kc will be virtually unused . . . thrown

away. Those few Extra and First licensees that use six will settle around 50.240 or so, just as on two meters there is a big crowd around 144.9 mc. If the FCC or anyone else thinks for a minute that the desert between 50.00 and 50.25 is going to exert even the slightest pressure to induce Techs to get a First Class grade license then they should look up a good psychiatrist for they have left the world of reality and are projecting fantasies.

75 Meters

While the loss of 3800-3900 will not affect half of the denizens of 75, it will be a serious loss to the small band of DXers and those of us that come out from under the rocks for contests. Contesting and DXing will no longer be possible without the Extra license for CW or First for phone. Eventually I suppose that most ops will get their First or Extra and this 100 kc will be as crowded as any other, but for a few years it should be like playing in a vacant lot to operate there. On the other hand, the high half of the band can't really get a lot worse than it is now, except that round tables will have one hundred participants instead of only fifty. We'll all have time to check in, if we make it short . . . never mind checking out . . . check anyone out after two hours if you don't hear him recheck in.

40 Meters

Those now operating in the 7200-7250 segment will find other Radio Moscow and VOA powerhouses to compete with when they move up. Good luck to you all. RTTY will have to move off 7040 to leave room for the Extras to work all that DX in "DX-Alley."

20 Meters

Here is where not having an Extra will really hurt. All that DX on the low end will be working Extras . . . not *you*. Same in the phone band. 14.000-14.050 for CW and 14.200-14.275 for phone. Of course a few DX stations do come up into the sideband end of the band . . . but they'll get out of there when everyone is squeezed up to that end of the band.

I expect that DXing is on of the activities that most of us General and Advanced will miss the most. With the new allocations it will be extremely difficult to work much DX any more . . . except when ten meters opens in a few years. Well, perhaps the FCC has lost interest in the international goodwill part of Basis and Purpose. Now that we have reciprocation perhaps they are depending on foreign hams to come over here and work us.

Call Signs

The League seems to be very worried about this one. I note that League officials are rushing around talking to as many clubs as possible, trying to get support for the docket, and they preface their talks with, "Neglecting the proposed change in calls, what objections do you have to . . . ?"

How do you neglect something like that? My call is just like a name to me . . . isn't yours? I've been known as W2NSD for 25 years now, except for short periods as W4NSD and W8NSD . . . and I sure hate to think of being KA1PJ or something. Very disturbing.

Apathy

But, as I read through the FCC release in detail . . . reprinted here for your perusal . . . I can see that the handwriting is on the wall. I don't believe that anything I can say or do will stop the power of The ARRL Clique. Certainly one little editor up in New Hampshire can't even begin to beat down the political influence of Herb Hoover Jr., et al.

The Future

I expect that the new regs will be passed pretty much as proposed. I predict a lot of grumbling . . . a few soreheads will quit ham radio in disgust or fury . . .we'll have a lot of Extra and First Class licensees . . . and then there will be a general settling back into the new pattern of things. In five years I doubt if we'll notice much difference.

Sure, a lot of us are going to have to struggle with the code . . . we will curse it as a hangover from ages past and of little value in our modern world . . . but we will get it up to 20 wpm this time before we stop using it instead of 13, hoping that something like this never happens again. I'll bet that most of you phone men can't copy much over 8-10 wpm right now . . . and I'll bet that you'll be right back there within two years after you get your Extra or First.

The theory will be a nuisance to have to memorize again. If only it had something more to do with operating or building. Well, we did it before, we can do it again . . . and we'll have the new ARRL *License Manual* to memorize from . . . the League should make at least $100,000 out of the new Manual, including all the advertising in it.

I don't know about you, but I've got the Epsilon record out and I'm working to get the Extra. You watch for WA1YN on twenty one of these days, y'hear?

Comments Received

While I had planned to print the better letters received on 15928, the large number received has overwhelmed me. Many of them are quite well thought out and very few are

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Kit HA-14, 9 lbs.....$99.95

HA-14 SPECIFICATIONS—Band coverage: 80, 40, 20, 15, and 10 meters. **Maximum power input:** SSB, 1000 watts P.E.P. **Driving power required:** 100 watts P.E.P. **Duty cycle:** 50% (SSB voice modulation). **Third order distortion:** —30 db or better at 1000 watts P.E.P. **Output impedance:** Fixed at 50 to 75 ohms unbalanced. SWR not to exceed 2:1. **Input impedance:** 52 ohms unbalanced; broad-band pretuned input circuit. **Meter functions:** 0-6 relative power & 1:1 to 3:1 SWR. **Front panel controls:** Tuning, band switch, relative power sensitivity control, meter switch (FWD & SWR), power switch (off, on). **Tube complement:** Two 572-B (or two T160-L) in parallel. **Power requirements:** 2000 VDC at 500 ma SSB peak, —110 VDC at 60 ma, and 12.6 VDC at 4 amperes. **Cabinet size:** 12-3/16" W x 3-3/16" H x 10" D. **Net weight:** 7 lbs.

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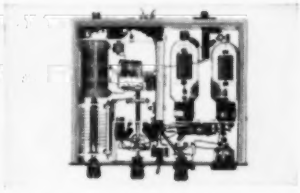

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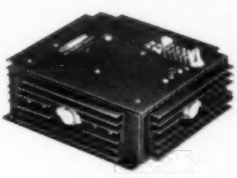

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The HP-14 Mobile power supply uses all solid-state circuitry. Switching frequency is 1500 cps. A toroidal core transformer for efficiency and regulation. Recommended for operation only with 12 V alternator equipped cars. Circuit breaker protected. The HP-14 provides all necessary operating voltages for mobile operation of the HA-14. Input voltage 12 to 14.5 VDC, negative ground, 25 amps average, 50 amps peak. 8 3/8" W x 2 5/8" H x 7 3/4" D.

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just emotional outbursts in outrage. Now, if I've received over 550 comments on the Docket, imagine what must be happening down in Newington! About 10% of the comments here are in favor of the docket, though many of them have reservations about the call letter changes.

Let me briefly cover some of the arguments brought up in the mountain of comments: Ham radio is a hobby so how come we have to pass license exams which are just as stiff as those for professional licenses? The Advanced Class (Class A) are getting a dirty deal since they are all older hams and would find studying for a new exam far more difficult than a youngster would. Why is CW necessary for the phone man? If we bring RTTY gear to the FCC exam can we use that instead of CW? In case of emergency we need experienced operators not engineers and CW speed demons. 50 kc is far too wide for the few Extra Class licensees and foreign commercial and government stations will have a field day in the choice empty bands. Foreign governments don't care whether we are engineers or idiots, all they want are our frequencies. We should enforce our present laws instead of building law on law in a patchwork quilt to solve problems. The proposed changes won't accomplish anything. The Extra Class license should be awarded to amateurs who provide extra service. We should work out a system of policing ourselves instead of depending on the FCC to do it. Where does ARRL get off bringing this mess down on us with their RM-499? Is it true that there are only two Extra Class licenses in the ARRL HQ organization? Instead of splitting up the already overcrowded phone bands why not recognize the present preponderance of phone and open more phone bands for the higher class license? How about opening 3575-3625 kc for phone so we can work DX phone stations on their own frequency? How about phone on 7175-7225 kc for the same reason? And phone on 14150-14200 is long overdue. These largely unused bands are being filled with foreign commercial stations and should be opened to amateur phone. 13 wpm is more than high enough speed for code, for when conditions are so bad that sideband won't get through you certainly aren't going to make it with fast CW. Old timers will have great difficulty in increasing their code speed, and some have trouble writing these days. Segregation in the ham bands is a bad thing as we certainly have learned on our only segregated band, two meters; so why duplicate a proven loser? The big problem we have with amateur radio these days is a few inconsiderate operators and, unfortunately, these are probably the first that we will see on the new bands. The amateurs who are bettering the state of the art will do this without any special licenses; certainly no ham is going to brush up on his theory to pass a test and suddenly come up with a new discovery for us all as a result. No other field grants licenses and then later takes away the privileges granted by the license. The First Class license seems unnecessary, however if it must go through the Advanced Class license it should be automatically upgraded. The Technician license should be returned to an experimenter's license and phone privileges should be removed from two and six meters. All amateurs should have to pass a 20 wpm code test. The Technicians should be given a CW band so they can learn the code. One letter calls will be good for special events. Two letter calls will be good for club stations. The docket quotes individual "experts" who are unnamed, but sound strangely like certain influential League supporters who are well known for their bias. The docket suggests that the 85,000 ARRL members are in favor of RM-499, while an actual count of the comments by an impartial group of amateurs showed that only a fraction approved. At present only 33% of the amateur bands are allocated for phone, yet surveys show that over 75% of the present day operation is on phone and that less than 20% of the amateurs spend more than 50% of their operating time on CW; isn't it time that the phone allocations were expanded? How many hundreds of more FCC employees will be needed to administer the new tests and is there any precedent in history for even one of these men to *ever* get fired? Since docket 15928 obviously does not provide a solution to the problem perhaps a survey and fact finding committee should be appointed by the FCC to come up with recommendations. Message handling and nets should be curtailed to open more frequencies. CW is a dying mode so why not reduce the code requirement to eight or ten wpm, which is satisfactory for emergencies? 15928 will do the job with a minimum of relocation, let's not squabble over minor details. The newly proposed bands would virtually eliminate DX work for anything but Extra on CW and First and Extra on phone. Class distinction will make more friction. What will new calls do to presently held permanent call letter license plates? How much will ARRL make on their new "First Class License Manual?" The Advanced Class license should not be down-graded to General.

You get the idea.

It Seems To Me

After considering all aspects of the docket I am certain that the FCC put in that bit about changing the call letters as a smoke screen to ease the rest of the docket through. The idea was to present something extremely unpalatable that they could change in the final rules, thereby relieving all of us. In the meantime, while we fuss and fret over the threatened call letter changes, we may let the other parts of the docket go through by default. If they do adopt a system of identifying call letters, I expect they will use a system such as I proposed in RM-577 (see May 1964 73 page 89) wherein an extra letter is added to indicate the class of license.

What I'm saying is, don't spend so much of your time and effort fuming over the call letters that you lose sight of the rest of this package and what it will do to ham radio.

What To Do

Docket 15928 is such a jumble of blunders that desperate measures are called for. First of all, present your reasons why you think it should be killed outright and send them with the usual 14 copies to the FCC, Washington 25, D. C., marked as comments on docket 15928.

Now, when you have that bundle sent off, write a letter to your Senator or Representative, explaining to him briefly what your problem is and making sure that he knows that you want 15928 killed outright. Your Congressman will already have a letter from the Institute of Amateur Radio explaining the basics of the situation, so you won't be approaching him cold.

Finally, and by far the most important of all, one more man should have a letter from you on his desk. Have you ever gone round and round with the Customer Relations department of a big company? Have you then, in desperation, written the president of the company? Well, if you've done this then you know that your letter to the president of the company invariably gets you action . . . good fast action and satisfaction. The Man in this case is Senator Warren G. Magnuson of Washington and his address is 127 Old Senate Office Building, Washington, D. C. 20510. Be sure to write Senator Magnuson, explaining briefly your arguments against docket 15928 and send a carbon copy of your letter to FCC Chairman E. William Henry, FCC, Washington 25, D. C. 14 copies not needed for these gentlemen.

The explosion from 15928 has been so resounding that I understand that there is considerable pressure for a Congressional investigation of the matter to see what happened and why and who made it happen.

We *do* have problems in ham radio. I think that idea about turning a committee loose on the problem is a good one. The first thing we need is a statement of the problem . . . and from there it shouldn't be so difficult to work out some reasonable answers. But first of all, let's get that 15928 out of here. The responsibility for what happens to ham radio is yours . . . if you speak up we can keep a pretty fine hobby going . . . if you don't holler now then we all will suffer.

What Can Be Done About The ARRL Clique?

Letters from all over the country ask the same question: "What can *I* do to help?" I'll admit that this is a tough question. One thing I do know: none of the normal ways are going to work. Serious hams are understandably concerned over the ruthless and destructive direction the League has taken under the new controlling clique. They read the documentation on one disaster after another in K6BX's *Newsletter* . . . they watch ham magazines crippled and killed for opposing The Clique.

What *can* the average ham do to fight The Clique? Well, The Clique has an answer for that . . . if you don't approve of what is going on all you have to do is tell your director and if he doesn't make things right vote for a new director. This is a wonderful answer . . . so democratic . . . so ideal. And they are laughing up their sleeves because they know full well that they have things under complete control and that all anyone can possibly do through regular channels is to wear himself out without even a ripple being felt in Newington.

If we can't get a message to the top using the methods suggested by The Clique and repeated in *QST* and all dutiful member club bulletins, how can we let them know that we are opposed to their actions?

Simple, really . . . there is one way to reach them with a loud clear message: Join the Institute of Amateur Radio. This is one thing that they understand. They are frightened of the Institute and are fighting it in every way they know . . . through attacks in controlled club bulletins . . . through letters to member clubs . . . through fellow-traveling *CQ Magazine* editorials and through attacks and insinuating comments at hamfests, conventions and club meetings.

The ferocity of their objections to the Institute tell you clearly that this is the most effective answer to The Clique. If you join the

Institute . . . and all the members of your club join the Institute . . . it won't be long before even The Clique will understand that they are not omnipotent . . . and it won't be long before the ARRL directors face up to their responsibility and update the management of the League. This will be a move that will help ham radio more than any other single action yet conceived.

I look to the day when the Institute and the League are able to work together . . . possibly even join . . . and carry out the programs of each organization for the betterment and survival of amateur radio. I believe that all of us should support the organizations that are working for our benefit . . . and right now this means the Institute.

Advertising Executive Wanted

One of the reasons why 73 hasn't more advertising is that I have been the sole ad salesman . . . a job I am psychologically unsuited for. Each month I know that I should call prospective advertisers and encourage them to patronize 73, but I get so depressed when I'm turned down that I use every possible excuse not to make the calls. I'm afraid that I must admit that most of our advertisers are using 73 because they took the initiative and called me first. Lousy way to run a business.

What we need here most desperately is someone who can take a no with a smile. There is no question in my mind that 73 is the best deal by far for advertisers and that every manufacturer and major distributor would be advertising in 73 every month if only someone here knew how to get the story across. Few magazines in any field can come up with the advertising success stories that we have in our files.

The question is this: is there one ham among our readership who has a good background as a salesman . . . knows his ham radio . . . who would enjoy the unconventional life up here in the New Hampshire mountains . . . and who is willing to gamble on our growth? With a good salesman I am convinced that we would not just stay a little ahead of CQ in pages of advertising, but could out do QST.

Salary? I'm offering an unusual deal . . . hoping for an unusual man. I'll pay a salary on a percentage basis . . . the more sales the higher the salary . . . 5% of our advertising income. If we had QST's ad income this would be in the neighborhood of $$20,000 a year . . . and if we can expand to that it will be worth it. We're only making about a third of that right now.

If you really think you can do the job and have enough background to make it a good bet for us then send in a resumé and we'll talk it over. Send resumés after June first since I'll be in Europe during May.

For Sale?

I understand that another publisher has been gossiping about me again. Tsk, tsk. This time the word is that 73 is for sale and I'm quitting. Oh, what wishful thinking that is.

Dxing

As a matter of ego gratification I thought I'd mention a "typical" day in the life of a test pilot for ham gear. On May 3rd I was testing the Henry 2K linear (what a tough life we editors live!) and I spent about nine hours on twenty meters. During that time I worked 161 stations, including the following DX; in the order contacted: KL7, KX6, PY, VE, XE, ZK1, GW, G, DJ, FS7, KR6, UQ2, MP4, OZ, 4X4, GM, F, CN8, SVØ-Crete, UB5, UD6, LA, VP9, 9G1, VP2, TG9, ZP, HC, VP1. This was all on SSB, by the way.

As we go to press I have been operating twelve days with the 2K, about 3-4 hours a day, and I have contacted 100 countries.

Personal Stuff

After living up here in ski country for over two years I finally got hornswaggled into trying to ski. I managed to put it off until April first, so I only had four days in which to endanger my life. I loved it . . . and, with some top instruction, I got so I could get around quite satisfactorily. I'm hooked.

Not satisfied with surviving the ski season without even one fall, I decided it was time my Arab stud, now three years old, had someone on his back. May I take this time to highly recommend that you 42 year old desk jockies don't stupidly go out and jump on an unbroken Arabian Stallion. It only hurts when I laugh . . . one broken finger and two cracked ribs.

Just after this issue goes to press I'll take my ribs over to Europe to attend the ITU 100th Anniversary doings plus a visit to as many VHF ops as I can manage. I'll be back in time to put a few words in the next editorial, if I don't get arrested in Hungary, Czechoslovakia or East Germany.

We're getting ready for the big do up here on July 4th . . . I sure hope you are planning to come. I'll have tour guides for seeing the most beautiful state in the Union . . . New Hampshire, plus visits to our humble abode and the 73 mountain shack. You'll have a chance at my unbelievable collection of ham gear at the auction . . . plus cash for your own stuff if you bring it for the auction. Looks like a ball.

. . . Wayne

Mosley

Trap·Master Beams Your Passport To World Wide DX

Engineered to meet today's band needs / tomorrow's band changes, Mosley Trap-Master beams remain *your passport to world-wide DX*. Yes, now is the time to add the finishing touch to your station - Trap-Master by Mosley.

Consider TA-33, the superior quality beam known and respected by thousands of Hams throughout the world. TA-33 easily handles 1 KW AM on 10, 15 and 20 meters. Up to 8 db. forward gain. 20 db. or better front-to-back and 1.5/1 or better SWR. TA-33 features the original all metal encased traps, proved to last through years of faithful service.

For Hams with lower power needs, TA-33 Jr. is an ideal choice. Rated for 300 watts AM or CW - 1000 watts PEP on SSB. "Trap-Master Junior" is a *top-of-the-line high performance* beam that will boost your DX potential on 10, 15 and 20 meters. Features up to 8 db. forward gain - - 20 db. or better front-to-back and 1.5/1 or better SWR. TA-33 Jr. incorporates the famous Trap-Master All Metal Encased Traps, the mark of distinction in tri-band beams. An added *"plus feature"* of this beam is its ability to be easily converted into a version of the *NEW MP-33 "Tig-Array"* when you increase power.

The newest addition to the Mosley Trap-Master family and direct decendent of the TA-33 is the MP-33 Tig-Array. Featuring top 3 band performance on 10, 15 and 20 meters. Rated for 750 watts AM/CW, 2000 watts PEP on SSB. Here in the *medium powered performer* designed in the true Trap-Master tradition. Again features the high performance all metal encased traps, pioneered and developed by Mosley for dependable multi-band operation.

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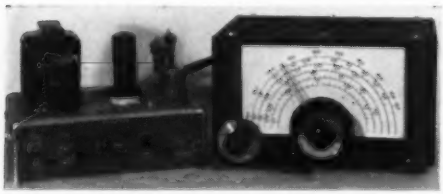
R. F. Van Wickle W6TKA
643 Aurora Avenue
Santa Barbara, Calif.

A VFO With FSK Provisions

I operate both teletype and sideband and I wanted a minimum-drift VFO with frequency-shift keying provisions. One fact I learned some time ago was that an excellent way to minimize drift caused by heat is to isolate the tuned circuit in one box and the heat-generating components elsewhere. Also, let the VFO run continuously. Keying the oscillator can be a cause of drift.

I have learned that it is important to use leads as short as possible in the tuned circuit and make them of #12, or heavier, wire. If the length of the lead is much over an inch or so, it should be supported at mid-point by a ceramic standoff insulator. Make sure, too, that all components in the tuned circuit box are securely fastened down. You should be able to pound on the surface on which the tuned circuit is placed without having the frequency change.

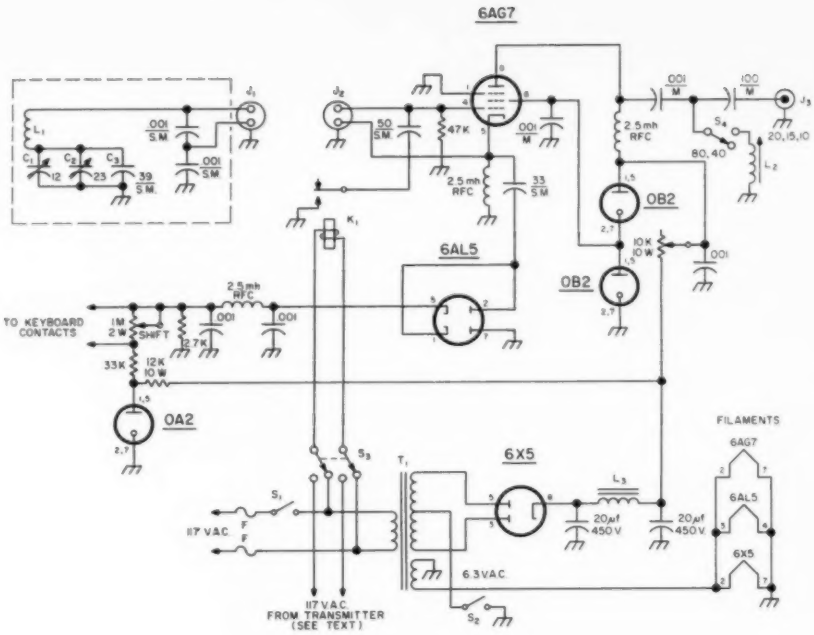


Front view of the two units. The connecting RG-22/U cable is seen in the background.

Shown in the photos and in Fig. 1, this VFO uses a series-tuned Colpitts circuit, with a 6AG7 as the oscillator tube. The plate voltage is regulated at 216 volts, and the screen-grid voltage, regulated at 108 volts, is taken from the point between the two OB2 regulator tubes. A little more output can be obtained by increasing the screen voltage to equal the plate voltage, but since this VFO is not intended as a power-generating device, we used the lower voltage for the screen grid. Adequate drive to our exciter, which uses a 5763 buffer and a 5763 buffer/multiplier driving a pair of 6146's, is obtained from 80 through 10 meters.

The coil L2 is slug-tuned to resonate in the 40 meter band. Additional output is obtained on 20, 15, and 10 meters by switching the coil into the circuit. It is switched out of the circuit during operation on 80 and 40 meters, resulting in an untuned output circuit. With most transmitters, the coil should not need to be in the circuit in 40 meter operation.

A trick we used on a two-meter VFO, described in 73 last year, was also employed in this VFO. The idea, originally supplied by W6CEM, allows the VFO to run continuously, thus eliminating keying the oscillator. The relay, K1, is used to add 50 pf capacitance to the 6AG7 grid circuit during receive periods.

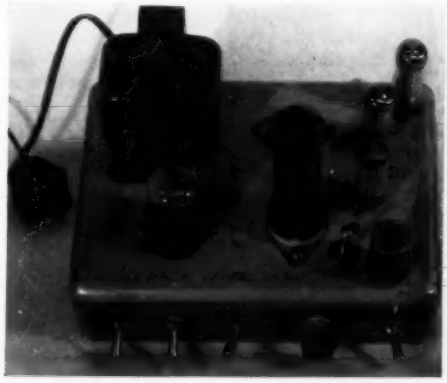


FSK VFO

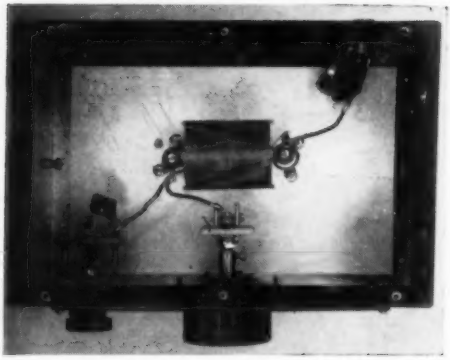
This capacitance takes the signal from the VFO far enough down the band, even on 80 meters, so that you don't run into your own signal when tuning around, unless you are listening 15 kc (on 80) away from your transmitting frequency.

To zero-beat a station, the dpdt switch, S3, applies 115 vac to the relay coil, closes it, and removes the added capacitance from the grid circuit. During transmit periods, the relay obtains its 115 vac from the transmitter transmit/receive switch. If your rig does not contain such a feature, it should be easy to add. In our transmitter we use a dpdt switch to provide 115 vac for the VFO frequency-change relay and for another relay, located in the transmitter, which grounds the oscillator and final cathodes during transmitting.

The frequency-shift keying circuit is straightforward and has been covered thoroughly in other literature. Briefly, the 6AL5 acts as an electronic switch. When the tube conducts, it



Top view of the oscillator-FSK-power supply chassis. The OA2 voltage regulator tube, for the FSK circuit, is at the right rear of the chassis. The two OB2s, for the oscillator circuit, are to the left and ahead of the OA2. The shield at the front right corner covers the 6AL5 FSK tube. The 6AG7 is located directly in front of the octal socket, which provides connections to the teletype machine. The 6AX5 rectifier is to the left of the 6AG7. The slug-tuned output coil is located to the left of the 6AL5. The ac power connector, in the background to the left, is an Elmenco fused plug.



The tuned circuit box. The two .001 uf silver mica capacitors are mounted at the twin-axial connector.

Parts List

C1—Cardwell PL-6001 with last rotor plate removed.
C2—Hammarlund HF-35 with last stator plate removed.
J1, J2—UG-103/U panel-mounted connector.
J3—RCA phono plug.
K1—spst relay, 115 vac.
L1—Barker & Williamson 80-BCL coil with link and base removed.
L2—30 turns #26 enameled copper wire wound on ⅜-inch ceramic form, slug tuned.
L3—Broadcast receiver replacement-type choke.
P1—Elmenco fused line plug.
S1, S2, S4—SPST toggle switch.
S3—dpdt toggle switch.
T1—Stancor #PC-8418 power transformer (230-0-230 volts @ 50 ma; 6.3 V @ 2.5 a).

connects the 33 pf silver-mica capacitor to ground, through the tube. Voltage for the 6AL5 is obtained through the one megohm potentiometer, which determines the amount of the shift. The OA2 voltage regulator prevents changes in line voltage from affecting the amount of frequency shift once it has been set by the potentiometer.

Using the values shown in the FSK circuit, sufficient frequency shift is obtained on 80 meters to allow 850 cycle RTTY frequency-shift keying. The shift potentiometer allows the shift to be varied appropriately for the band in use.

The tuned circuit is built in an aluminum utility box, black hammertone finished, 5″ × 6″ × 9″ (California Chassis #CAB-5). The coil, B & W JEL-80, has the base and the link carefully removed. The remaining polystyrene mounting rod is mounted on two National GS-1 pillar insulators, which, in turn, are mounted on the bottom of the box. The bandset capacitor, C2, is mounted in the lower left-hand corner of the panel. You will have to drill a hole through the edge of the National ACN-1 to mount the capacitor. The 39pf silver-mica capacitor is mounted across the bandset capacitor terminals.

Any good-quality three-terminal connectors can be used on the tuned circuit and oscillator chassis. I used UG-103 connectors, but these are not polarized, and it is essential that the connections between the tuned circuit and oscillator chassis be made as shown in the schematic or the unit will not oscillate. I used small globs of red paint on the panel and cable connectors to indicate polarization. RG-22/U two-conductor shielded is the cable used.

The oscillator, frequency-shift keyer, and power supply are built on a deep-drawn aluminum chassis measuring 8″ × 5½″ × 2½″. I must have scrounged the chassis from somewhere, but from where I do not remember. The chassis does not seem to be commercially available, and the two Bud or California Chassis Co. chassis nearest those dimensions are 2½″ × 9½″ × 5″, and 2″ × 9″ × 7″. Take your pick; either will be adequate.

A word of warning: When building a VFO don't try to save money on, of all things, capacitors. Buy good-quality silver-mica capacitors for both the VFO and FSK circuits. The familiar, inexpensive ceramic capacitors may be fine in some applications, but they do not belong in any frequency-determining circuit.

The VFO was calibrated by using a BC-221 frequency meter. The initial calibrated dial was accurate but unattractive, so a new dial was drawn, using a compass and india ink, and the calibration points marked through the first dial onto the new one by holding the two dials in perfect alignment and making calibration marks on the new dial. The two dials were taped to a window facing the sun, so that the original dial markings could be seen through and onto the new dial. The numbers are "Instant Lettering," a very handy source for letters and numbers. The letters and numbers are available in large sheets and are applied simply by burnishing them onto the surface to which you want to apply them.

We've been quite satisfied with the performance of this VFO, and hope you will be, too. Drift seems negligible, even when "coming on cold."

. . . W6TKA

DK DOW-KEY

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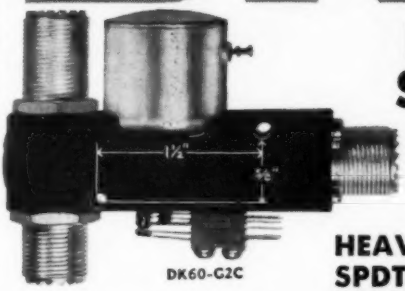

DK60-G2C

DK60 SERIES

Size: 2¾ x 3¾ x 1⅛. Wt. 9 oz.

HEAVY DUTY SPDT COAXIAL RELAYS . . .

4 Standard Models, AC or DC, UHF, N, BNC, TNC or C Connectors.

SPDT 50 ohm impedance. 1 kw rating. Life expectancy over 1 million operations. VSWR less than 1.15:1 from 0 to 500 mc. DK60-G and DK60-G2C feature patented automatic receiver protecting connector for positive isolation of r.f. from receiver — greater than 100 db isolation between receiver and transmitter lines from 0 to 500 mc. Model DK60-G2C has external contacts for switching auxiliary circuits (rated 5 amps @ 110 VAC).

Guaranteed One Year

DK60 r.f. Switch	$12.45
DK60-G with "isolation" Conn.	$13.70
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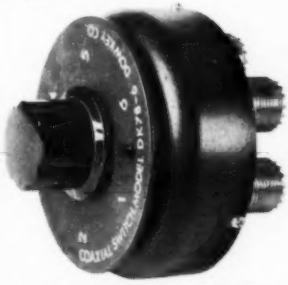
Industrial and military requirements modified and built to specifications.



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NEW MANUAL COAXIAL SWITCHES

(not wafer switches)

Available in four configurations — DK78-2 single two throw; DK78-3 single pole three throw; DK78-6 single pole six throw, and Crossover switch DK78-T.

New manual DK78 series coaxial switches with excellent r.f. characteristics (not wafer switches). r.f. rating, 1 kw. 50 ohm impedance. VSWR less than 1.05:1 at 150 mc. Isolation greater than 50 db @ 500 mc. and greater than 80 db @ 30 mc. With dial plate and knob. Wt. 10 oz. Size: 3" dia. x 1⅛" deep.

Available: 1P2T, SP3T, 1P6T and crossover switch ..... **from $12.75 ea.**

DK60, DK2-60, DK2-60B, DK71, DK72 DK78 available with BNC, TNC, N & C connectors.

DK2-60B

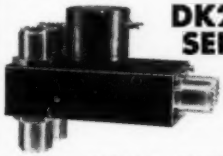
DK2-60B SERIES

Connectors UHF.
Size 2¾ x 3¾ x 1¾. Wt. 12 oz.

A DPDT SWITCH INTERNALLY CONNECTED IN DE-ENERGIZED POSITION

Ideal for switching in and out a power amplifier between an exciter and antenna. Frequency range 0 to 500 mc. Power rating 1 kw. VSWR less than 1.15:1 from 0 to 500 mc. Isolation greater than 30 db @ 500 mc. Loss less than 0.03 db @ 30 mc. Life over 1,000,000 operations. 50 ohm impedance.

Available in all standard AC, DC voltages ..... **from $19.00 ea.**



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Frequency range 0 to 500 mc. Power rating to 1 kw. VSWR less than 1.15:1 from 0 to 500 mc. Isolation greater than 30 db @ 500 mc. Loss less than 0.03 db @ 30 mc. Life over 1,000,000 operations. 50 ohm impedance. Size: 2⅝ x 3⅜ x 1¾. Wt. 12 oz.

With UHF COAXIAL CONNECTORS ..... **from $19.00 ea.**

DK72

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Weatherproof. Frequency range 0 to 500 mc. Power rating 1 kw. VSWR less than 1.1:1 at 100 mc. Isolation greater than 40 db at 100 mc. Life over 1,000,000 operations. 50 ohm impedance. Size: 4 x 3½ x 2⅝. Wt. 1 lb. 8 oz.

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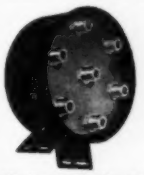

DK71 SERIES

IP6T COAXIAL RELAY FOR SWITCHING of r.f. SOURCES

Size: 5¾ dia., 2¾ deep. Wt. 3 lbs.

Weatherproof. Common connector may be switched directly to any one or combination of six positions. Frequency range 0 to 500 mc. Power rating 1 kw. VSWR less than 1.1:1 at 100 mc. Isolation greater than 40 db at 100 mc. 1,000,000 operations. 50 ohm impedance.

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Shoulder-Strap Portable

There are times when several developments that seem to grow up more or less independently can be assembled together in what the French call a "happy marriage." This is the case with the instant-heating 5816 tube; the really non-spillable, non-gassing, small and low-cost storage battery; good portable beams; practically wattless low-noise transistor receivers, and last but far from least, the increasing occupancy of the VHF bands, namely, 6 and 2, where reasonably sized portable antennas are practical.

When put together, these ingredients make for a new-type of amateur station. This is the shoulder-strap portable rig, a real emergency type with which you can get out and away from the car, walk (or climb) up that mountain or five tower for an additional 50 to 500 feet of elevation. (This also gets you away from super-regenerating Six'ers!) For *real* camping it is excellent, and it is always a nice thought to have a good, selective, complete emergency rig on hand. (One that doesn't need an AC plug!)

Starting with the 5816 tube, we find here a little marvel: the miniature equivalent of a 6L6GT. It uses 6 volts, but is instant-heating. This means what it says. You do not have to leave the transmitting filaments on while receiving. This type of operation is no news to mobile rig designers, but there seems to be a great number of amateurs that are not familiar with it. Don't forget that while receiving, zero transmitter power is used, and you have to carry that power.

There is only one precaution with the 5816. Do not run the screen at more than 75 volts. This is a red-hot beam power tube and will perform miracles when used right. It also uses only 225 ma of filament current.

Now for the circuit: Fig. 1 shows the 3 tube 6 meter unit. Nothing has been left out. It has 100% modulation, crystal control, and runs up to 7½ watts input, but to play it safe, keep it at 5.

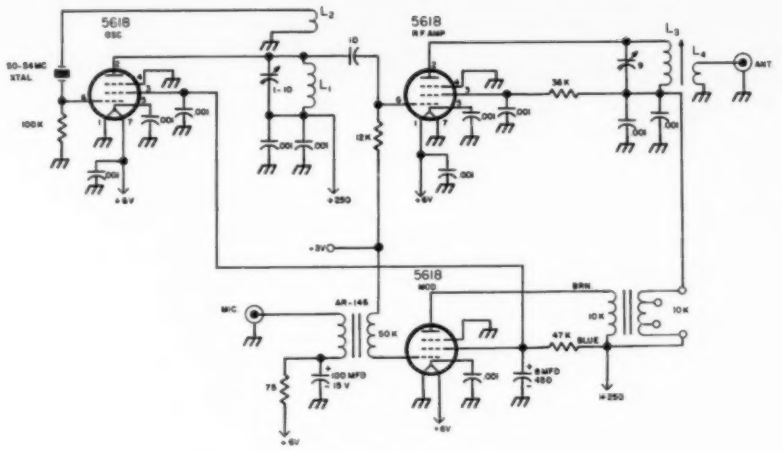
Much has been written about VHF crystal oscillators and a lot of work has been done on them. The one shown has patents pending (yours truly) and is the result of many years experience.

Just be sure and use *non*-regenerative feedback coupling in the grid-crystal circuit from the plate. This prevents all oscillation until you reach the crystal resonant frequency. At this point (crystals with ac on them always develop plus voltage on one side, minus on the other, at any given moment) the crystal will reverse the phase and apply good regenerative voltage to the grid. A lot of handbooks tell you to use regenerative coupling to help VHF crystals. Well, here is one circuit that works better the other way!

The plate circuit uses the well-known B & W air-wound coils. Every amateur should have a selection of these on hand for any and every use. They do work much better than slug-tuned coils if you have the room, cutting down TV and FM harmonics and pulling in 6 meters only! Copper-clad bakelite makes a good easy-to-build base, and provides an excellent ground. Don't forget the VHF and up rule: a "ground" is a place where most all of the rf has been brought to a halt. You can bring bypasses, coil returns, tube filaments (in this rig) etc., to this point and they will stay quiet. The trick with the copper-clad bakelite is mechanical strength, light weight, and it solders with a touch-of-the-iron.

A good trick in the B+ bypassing for rf coils at VHF frequencies is to use more than one capacitor. Just be sure of the voltage rating. When you do this, you can ground the shaft of the tuning capacitor rotor. There is some choice in CV1. If you stay within half of a megacycle on the band this can be a trimmer. If you want to cover 50 to 54, bring the shaft of a Hammarlund midget out to the front panel with a piece of insulated shaft.

Use light coupling to the final grid. This doesn't load the oscillator too much, and re-



Shoulder-strap portable.

member that the 5816 is red hot and doesn't need much drive. The final grid is furnished with bias as a precaution.

The rf final has the capacitor CV2 directly across the coil. It is better to take a little time for this for this is where the *power* is, and a class C amplifier needs every drop of "Q" it can get. Mount CV2 on a separate piece of bakelite, using an *insulated* shaft on it.

A swinging link completes the output circuit, unless you want to couple in a power output monitoring diode at this point. (We did.) Couple it to the antenna jack, not the coil. With a little more work you can make the link adjustable from the outside. (We didn't.)

The modulator uses a carbon mike. (You cannot use a crystal mike without considerably more circuitry and battery drain.) If you use Western Electric F1 surplus buttons, the quality will be definitely good. A high gain transformer, Argonne (Lafayette) no. AR-146, primary 30 ohms, secondary 50 k gives plenty of audio drive on the grid. Incidentally, we have used a transformer with a 300 k secondary with even better modulation. Be sure to use the voltage dropping resistor and bypass shown for the mike voltage. 1.5 volts is ok. The modulation transformer is a standard low-cost job just suited to this purpose and rated at 5 watts. Connect it as indicated on the diagram.

Any dc to dc converter may be used, but do not go over 300 volts. 225 or 250 is plenty. A power saver switch on the supply, cutting the B+ to about half, is a good idea for local contacts. Don't forget, if you use this rig on a mountain top with a good portable beam, you will soon be surprised at the stations you consider "local"!

A word of caution here. Dc to dc power transistor circuits generate "spikes" on every possible occasion. Barrels of "dead soldiers" in many labs across the country have been the result of those reverse voltage spikes. The trick lies mainly in the transformers and, of course, push-pull. Barker and Williamson furnished this transformer. Triad also manufactures this type of unit. Maybe you should buy a ready-made kit. Anyway, this one has worked well now for over a year with no trouble. Incidentally, due to the low-drain receivers used, this supply is only turned on with the transmitter filaments.

And now for the portable battery that has the energy stored in it to get you on the air on that hill top. "Miracle" batteries have been featured in many articles since the war. Some of them really are miracles. Batteries small enough to be swallowed in a pill; batteries you can hold in your hand and that will furnish a kw of power (for one minute!); a D size flashlight cell with 14 ampere-hours of energy stored in it (that one always seemed to me to a real miracle!); etc. However, when first cost, weight, size, ease of charge, explosive power, "seeing what goes on" inside and compatibility of voltage with available tubes, ditto with car batteries; are all carefully considered, I always seem to end up with the old reliable lead-acid battery, but in a new

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Over 50,000 CB crystals in stock for all sets and channels, both HC6/U and miniature types. To insure proper correlation and correct freq. operation, order by manufacturer model number and channel.

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form. There is a lead-acid storage battery that really does the job for portable amateur work. It has transparent walls so you can see the water level and condition. It has a really non spillable baffle, vent, and plug arrangements so that only dry gas comes out when charging or discharging. I personally know this as a fact because I have charged and discharged this battery inside the case of the type of rig described in this article for over a year without damage to any of the coils or transformers! This is what is known as the "acid test."

Also, by starting with one small 6 volt unit and then adding more of them, you can get double ampere-hours (time on the air), or wattage (power on the air), or voltage (12 volt systems, or 24 volts for much more power), etc. However, here again there is a level above which it is better to use a straight ac gasoline driven generator. This of course, is beyond the definition of a "shoulder-strap portable." All this seems to show that there is going to be a power level limit for "portable" stations: that is, just how much power you can walk (or stagger) up a mountain with and then stay on the air for at least an hour or so.

Here are some suggested transmit-receive circuits for the 5 watter portable. A three-pole, double-throw slide switch has been used successfully for a year. Remember, this is still a low-cost station. Of the three sections, sw1 turns on the receiver filaments; sw2 switches the antenna; and sw3 turns on the 6 volts to the transmitter and transistorized dc to dc converter. A rotary 4 pole switch could also be used, but is more expensive.

Use coax cable right close up to the slide switch. This is ok at least up to 50 mc, especially if you use the copper-clad ground mentioned before.

For assembly of the complete rig, an arrangement consisting of ¾" plywood shelves, with ¼" sides, and a dowel handle across the top will prove satisfactory.

For the antenna, two 4½ foot aluminum pieces with two banana plugs each (4 total) plug into banana jacks on a piece of bakelite bolted to the top of a piece of 5 ft. TV aluminum masting makes a fb dipole that packs into a 5 ft. long thin package.

All these items together used on a mountain-top put you quite a ways away from the usual idea of a "walkie-talkie" rig, as you will find out. Be sure to make the battery and hv supply detachable and have output sockets on it, as more portable rigs are coming for 2 meters, 432 mc, etc!

. . . K1CLL

Charles Spitz W4API
1420 S. Randolph St.
Arlington 4, Va.

Superimposing 6 meters on your Tribander

Now that SSB transmitting converters are firmly fixed on the scene, many amateurs are faced with the erection of another antenna or beam. While there is no argument against the efficiency that will be obtained when a beam is designed for a specific frequency and independent from other arrays, many cliff dwellers and others just in a hurry can take advantage of this shortcut which adds little or no weight or cost to the operation.

We have long been familiar with the technique of tying resonant lengths of antennas to a common low impedance feedline, and the popular trap triband yagis have this point in their favor. Several factors enhance the addition of superimposing a six meter beam to the multiband antenna. One is that six is not harmonically related to these bands, thus not disturbing or being disturbed by the lower frequency lengths. These lower frequency antennas at their current points will now present a high impedance to the six meter portion when operating on six. Another factor is that closed spaced arrays predominate the multiband beam system, permitting six meter operation using the non-critical quarter wave spacing between elements at that frequency. This factor means less critical adjustment of lengths, broadbanding and retention of coax line impedances.

The theory behind the superimposition is that part of the original elements are used for a quarter wavelength around the current feed point of the antenna. Electrical resonance for six, and decoupling from the balance of the antenna is achieved by "drooping" ¼th wavelength at each end of this quarter wave, thus forming an electrical half wavelength circuit.

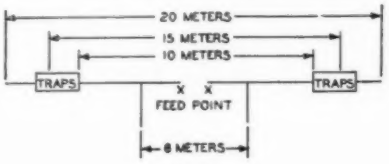

FIGURE 1

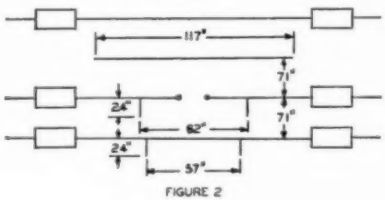

FIGURE 2

In order to visualize the physical structure, Fig. 1 illustrates a triband radiator element, in this case a Mosely TA-33, to which a six meter resonance is superimposed.

The final installation is shown in Fig. 2. The drops for the radiator and director for 50 mc are composed of 26" lengths of TV aluminum No. 8 ground wire, two inches being bent at right angles and inserted through hose clamps which grip the wire and basic antenna element. The wire is oriented to hang downwards. Aluminum rod could be used, but the short length of wire presented no problem in the installation.

Since the reflector in this arrangement was more than a quarter wavelength on six from the radiator, it was decided to add a reflector element. Obviously, an additional close spaced director element could be added to make a four element array from the system.

The dimensions for 50.0 mc are a total of 110 inches for the radiator, consisting of the hose clamps spaced 62 inches apart, equidistant from the common feedpoint center line, electrically completed in resonance with the two 24" drops. The director is 105 inches, using a 57 inch separation between hose clamps, also with two 24" drops. The reflector is a half-inch diameter piece of aluminum tubing 117 inches in length, and 71 inches behind the reflector.

If an additional director were to be used, a 105 inch piece of tubing could be placed halfway between the original director and radiator, and the triband director, now the second, would be a total of 104 inches or 56" between drops.

Obviously this is not the only application to which the superimposition system could be used, nor may these be ideal lengths and spacing for every situation and antenna. Lengths and spacings for 50.1 mc may be found on page 122 of the VHF Handbook. The system, of course, could be used with various types of antennas and for various frequencies. This should provide a fertile field limited only by the imagaination and application of the experimenter.

. . . W4API

Charles Leedham WA2TDH
101 W. 23rd St.
New York, N. Y.

The Waters Codax

Somewhere in, under or around the new Waters Codax there must be the switch I'm looking for—the one that turns on the heating element under the top so it will heat my coffee for me while I'm operating. It does everything else, so I can't see why they would have left that simple feature out.

What the Codax does do is send code for you so automatically and effortlessly that it almost seems to be wired straight into the nerve-endings, taking out of CW operation all the old pain of whangety-whang-whang on a straight key until your fingers go numb. It is also an audio-tone keyer which will make a CW transmitter out of an SSB or AM transmitter. And to top it off, it is a keying monitor and even a practice key. Do you wonder I'm looking for the heater switch?

Sitting there on the operating table, the Codax is a little thing, a pale-grey box with rounded edges, about 2½ high by 4 by 4, plus 2 inches of double paddle sticking out the front. But touch the left paddle with your thumb and the dots start rippling out, touch the other with your finger and the dashes flow. And I do mean touch. You can set the spacing and tension of the paddles to such a delicate point that a hard look will trip them. This of course causes a tendency at first to spray surplus dots around like a jittery BAR man, but this comes under control with a little practice.

Specifications: the Codax is a solid-state automatic keyer with the paddles built right in, the only addition required being six small 1.35-volt batteries supply all the power. Dots and dashes are made with a blocking oscillator set into motion by the paddles. Briefly, pulses from the oscillator are sent to a flip-flop which in turn operates a relay at whatever keying rate you have set on the dial. For dashes, the same oscillator pulses feed a second flip-flop operating at half the dot rate, which then goes through a gate opened by the dash paddle. In short, a dash is made up of one double-length dot followed instantaneously by a single dot, all this put together by a summing circuit. This may seem unnecessarily detailed unless you are a student of such things, but a moment's thought will show that by this method the dots, dashes and spaces are all kept in their proper proportion no matter what the speed. Also, as Waters points out, you don't have to wait for a running dash-oscillator to get around to making a dash after you press the paddle—the oscillator starts when you press.

The speed can be set anywhere from 5 to 50 wpm, according to the specs. I only know that I have run it up to about 25 in practice, far beyond my ability to tap on a straight key, and it still sounds smooth and regular. I still can't copy 25, but one of the features of the Codax is that I'm sure I will be able to soon. There's a kind of sticking point you get to, somewhere between 15 and 20, when you can't send any faster than with a straight key, but I know my own copying rate has gone up two or three wpm after only a few sessions with the keyer. Things go smoother and quicker from text to code, and the reverse seems to begin to operate. Hearing yourself send faster and smoother—and you do hear it with the Codax—you begin to get the hang of what fast code sounds like, and up goes your speed.

Here's the SPECTACULAR

NEW ALL TRANSISTOR
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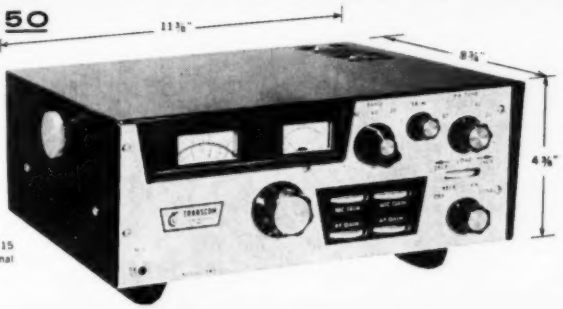
Freq. Range: 3780-4010 KC, 7180-7320 KC, 14130-14360 KC
Semiconductors: 2—8042 instant heating tubes, 18 transistors, 2—varicaps, 1—zener, 9 diodes
Size: 4⅞H x 11⅞W x 8¾D Weight 10 lbs

TRANSMITTER

Power Input: 165W pep
Carrier Suppression: 45 DB
S.B. Selection: 80 40M lower 20M upper
Unwanted SB: 40 DB
Ant. Imped.: 30-100 ohm adj
Power Consumption: 5 amps Receive, 12-15 amps SSB XMIT.
Operation: P. T. T. No tube filament on in rec

RECEIVER

Sensitivity: 5μv for 10 DB S + N/N
Selectivity: 3 KC @ 6 DB
Spurious: Image better than 60 DB
Stability: Less 100 cps in any 15 min. period under normal ambient conditions
Audio Output: 2 watts



TRANSCOM ELECTRONICS, INC.
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And there's more. Just in case you have one of those transceivers without CW provision, you can use the Codax to send code USB or LSB. Along with pulses for normal CW, the keyer generates an audio tone of about 1500 cycles at .05 volts, which can be fed right into your mike jack. I've tried it. It works. The first dit trips the VOX and the last one lets it drop, and you have break-in keying, sideband style. It'll do MCW code on AM, too, but remember it's illegal below 50 megs, while audio-keyed SSB is OK anywhere.

For monitoring purposes, either straight CW or audio, there is a phone jack on the back of the Codax. Plug in your phones and the panel volume control lets you listen to yourself key. Also, of course, you can plug in the phones without connecting the keyer to anything, which is an excellent idea at first, while you learn to send letters instead of sprays of dots and dashes. Oh yes, and if you want to feed your receiver audio into the phones at the same time, which is logical enough, you plug an already-wired phone plug into your receiver's phone jack. A mixer inside does all the work for you.

The Codax has provisions for grid-block keying for use with the lower priced transceivers which have a tendency to produce clicks and thumps when square wave audio is fed into their filters.

All the cables are already on the back of the box—one for wiring to whatever type of mike connector you use if you want audio keying, one with the phone plug, and one for key plug. In my own set-up, I just stuck the key-plug connections into the terminals of my straight key, so I'd have a way of holding key-down for tune-up (although you can tune quite nicely on a string of dashes), and also so I could go back and forth occasionally just for comparison.

There is, in fact, no comparison at all. In operation the Codax practically takes over the sending for you. The CQ DX's just ripple out, and in the course of QSO's I now find myself actually saying things, making conversation, instead of sticking to the old deadly round of RST, QTH, name, 73's es tnx fer fb qso om—keying is now so easy. I still spray an occasional extra dot or dash around as I keep pushing my copying and sending speed up, but, heh heh, it's right easy to send a string of "error" dits now.

Tired of that CW straight-key drudgery? Get fast (!) relief with Codax. . . . WA2TDH

Wayne Green W2NSD/

73 Tests the Henry 2K Linear

For quite some time I've been watching those Henry ads for their 2K linear. I've puzzled over it. Last summer when I got out to visit the Henry emporium personally I was taken aback to see that what looked like a six foot rack full of stuff in the pictures was in fact a rather normal sized linear amplifier sitting on a two foot high pedestal containing the power supply.

I wanted one . . . but I wasn't really sure. I wondered about why it was so big (small as it was) compared to some of the other linears available. I read their literature . . . and I started asking around. I found out!

Suddenly I found out why fellows are buying the Henry linear.

I found out why it is bigger than the others.

I found out why they call it the 2K.

This infernal machine will run two thousand watts . . . and I don't mean PEP watts either, I mean two thousand dc watts into a wattmeter or, ahem, a dummy load. Using the usual nomenclature, this is a 4000 watt PEP amplifier.

When mine arrived I discovered that the instruction book gives full instructions for using it within the legal amateur limits.

Shortly after it came work on 73 stopped and we hastily took down the Oscar antenna and put the Cushcraft three element 20M beam back up on the tower. Then we ran the 220v power cable (you can run it from 115v if your prefer) and plugged the Galaxy V transceiver in. One of the first things I heard as I tuned the band was a pileup calling a KJ6 . . . Johnston Island. That's good DX. tuned 'er up and gave a short call and back came KH6FBJ/KJ6 with news that I had the best signal on the frequency. Hmmm, and didn't ever talk it up over the 1 kw mark either.

The next morning around 11 am I sat back from my desk after answering all of the really urgent mail for the morning and decided to see what was coming through on 20M. Things were fairly calm except for one pileup . . . good heaven's, 9M4JY! And even more astounding . . . I am hearing him. He was just finishing up with a W3 and I could hear several big guns trying to get him to break . . . biting my lip, I waited for him to finish and then joined the pandemonium on the frequency. He came right back to me . . . name Yathe . . . Singapore . . . 5-5 . . . QSL please . . . etc. When we signed I recklessly called a CQDX . . . kind of showing off . . . and IS1ZDT gave me a 5-9 plus 20. Good grief!

What else can you say about a linear? The purpose of it is to improve your signal . . . to make you a little louder. The 2K accomplishes this. It uses a pair of 3-400Z's in parallel, tunes 80-10 meters with the flip of a switch. The blower on these tubes is the quietest I've heard yet . . . you can just barely tell that it is on. The 0-1 amp meter on the right is plate current and the left hand meter reads grid current or, with the push switch, plate voltage.

Linears can be a drag if you have to retune them every time you QSY a little bit. The 2K works over the entire twenty meter phone band for me with no retuning needed . . . I just zero in on a signal and call.

After three days of using the 2K I find that I have 35 countries worked, some of them on the rare side such as HI8, KJ6, GI, 9M4, IS, UA, VS9, 5Z4, TF, 9J2, CE1, UQ2, 7Z3, ZD8, 9L1, KS6 and CEØ. As Larry, KS6BO said, after telling me I had the loudest signal on the band, "Fellows with the Henry 2K always have outstanding signals."

. . . W2NSD/1

FULL SIZED PERFORMANCE IN A TRANSISTORIZED RECEIVER

Our formula for receiver design: Take the finest receiver on the market, modernize it, add a noise blanker, reduce it to about QSL size, add six meters and WWV, start building.

The Davco transistorsized receiver is the first receiver available to the amateur at an amateur radio price which is state-of-the-art in quality and performance. None of those hot fragile tubes to break and generate heat, none of those big if transformers for us—our whole if strip is smaller than the usual transformer. The Davco DR-30 has eight plug in micro-miniature circuit modules. The chassis and interstage shielding are all made of 3/16th inch aluminum for extreme rigidity. We use toroids, Clevite transfilters, a Collins mechanical filter, 14 crystals, 25 transistors, and 15 diodes—The results are spectacular. The Davco DR-30 receiver operates from 13 volts and draws only 40 mils with no input signal which is about half the current a pilot light lamp draws—explaining why there is so little heat generated. One-half watt, mostly expended in the loudspeaker, is not going to make much heat.

So who needs a micro-miniature receiver? Well, there may be a few of you who would like a full-fledged communications receiver that you can use in the car—take on trips—wear as a watch fob—or use at home. Before long we'll have a companion transmitter which will transceive with our receiver—and about the same size (4 inches high, by 7 inches wide).

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COVERAGE — Every kc. of 80, 40, 20, 15, 10 meters
plus 50.0 - 50.550 Mc. (6 meters)
plus WWV at 10 Mc.
plus expanded coverage for MARS, etc.
plus two more 550 kc. segments YOU can choose

SELECTIVITY — 2.1 kc. Collins Mechanical Filter for SSB
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STABILITY — **plus** broad IF position for AM crystal first conversion oscillator (10 crystals supplied)
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SENSITIVITY — .6 microvolt sensitivity, with tuned RF stage using premium UHF-type transistor (2N2495, with rated noise figure of 3db at 50 Mc.)

PLUS tunable rejection-notch filter for eliminating heterodynes
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and built-in 100 kc. crystal calibrator
and split-gear ball-bearing tuning mechanism
and separate AM and product detectors
and plug-in module subassembly construction
and new expanded warranty; designed and manufactured in USA
and transceive compatibility with companion DT-20 200-watt SSB transmitter
and size (1/10 cubic foot) and weight (nine pounds); installs anywhere

Send for free brochure explaining all of the features of this unique receiver.

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Drawings by Larry Howard

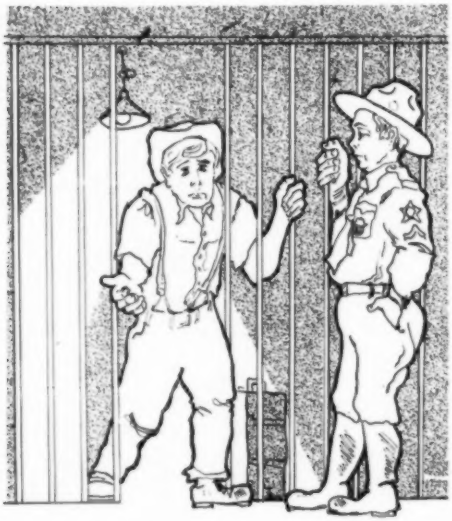
Gus Browning W4BPD

Gus

Part 11

While writing this second episode, Peggy and I are still up in Bhutan, with the world's nicest people.

I was on my way hitch hiking from Orlando to Philadelphia, so that I would be where there were power lines where I lived, as my father would not put in electricity at our home near Orlando. Well, I started with all of $2.50 in my pocket and to conserve my "bank roll" I was spending my nights in jail houses along the way. One of the deputies in a small town in North Carolina let me spend the night in their jail but when it came time for me to leave the next morning the deputy who let me in had gone on his annual vacation and he forgot to tell his relief about me just being a "visitor" in their jail. I called this fellow to my "cell" and asked to be let out so that I could be on my way. This jail keeper just laughed and said I would have to wait until my trial and if the judge would let me go it would be OK with him. Then he asked what had I done. I told him my story and he just laughed and said that was the best story he had ever heard; he even said he almost believed me. My trial was set for three days hence. Boy, here I was in jail for the first time in my life and for doing nothing. I asked him please to ask all the officers on the force what had I been arrested for. He did, and at the end he came to the conclusion that I was telling him the truth, so he let me out.



The jail keeper just laughed.

I proceeded on my way to Philly and finally arrived there about 11pm, and my brother who I was going to stay with was not at home and his land lady would not let me come in. (Good old Philly, the city of brotherly love!) So I just rode route 23 trolly all the rest of that night and returned to my brother's boarding house about 7am the next morning. Of course he was glad to see me and told me to go around to Philco and ask for a job with them.

Now here I was a real country boy trying to get a job, and there was a number of other people trying for the same job. The competi-

tion was very heavy with everyone trying to get into the trouble shooting department. Well, I must not have been too dumb because I got the job and about 20 fellows who took the verbal test were rejected. Now here I was doing what I really like to do. Radio work up to my ears, and plenty where it came from.

I had no radio equipment with me except a keying relay, a key, and an audio oscillator, which I proceeded to connect up for code practice. After a few weeks of nightly code practice, and saving my Rupees for some gear, I had a visitor. Can you imagine who it was? It was the Radio Inspector! He came upstairs to my room and knocked on the door and asked me if I had a radio transmiter in my room! I said no, but he said he would have to come in and see for himself. When he saw that I only had a code practice outfit he asked me to turn it on and to send my code practice for the next 5 minutes while he went next door to see if I were causing radio interference on that man's radio. I asked him who had reported me and he said Mr. ? ? ? ? ? ? next door, who was the fellow with whom I rode to work every day. (Good ole Philly, the city of brotherly love again!) I complied with his wishes and sent code on my audio oscillator for 4 or 5 minutes until he returned. I asked him if I were causing radio interference and he said no, but that my keying relay which was fastened to the wall was keeping his children awake at night. He told them this was a police complaint and not the radio inspector's business. While riding to work the next day with the complainee I asked him why didn't he tell me that I was keeping his kids awake with my code practice, and he said he didn't want to bother me with his problems! Boy, how crazy can some people get anyway?

After a few months I had my rig all fixed up, even to the receiver (yes, we built them those days) and had applied for a W3 call sign. I was given W3BBH which I used as long as I was in Philly. I even joined the Frankford Radio Club where I met old Jerry Mathis (W3BES) who used to really be the contest kid, and a real machine when he got going in a contest. I soon got a pair of 852's going with a good K.W. input and then I really started working DX. For the first time in my life I could hold my own in those little piles they used to have.

Even back in those days I started mentally to criticize the operation of DX stations, and began to think what I would do if I were in their shoes. I certainly didn't have any idea

Just a little house in the country.

that one day I would have the chance to practise what I preached. I was in Hogs Heaven: all day I worked on radios at Philco and almost all night I pounded brass, trying to work DX.

Even in those days I could hear W8CRA out in Cannonsburg working stations that no one else even called or heard. Sometimes I knew he was just pulling the gang's leg and was working a ghost just to fool everyone. Boys, don't sell Frank Lucas short; even here in Bhutan I hear him sometimes when there are no other USA stations coming through, but I think CRA has competition in the form of W5VA. When CRA fades out and skip conditions change, then I start hearing W5VA who puts out a FB signal too. Its a pity that both of these Franks (CRA and VA) are not in the same call area so that their signals could be compared with each other. An honest comparison is almost impossible, because some days conditions are not right for maybe W3 and other days for W5. They both peak about 1 hour apart. It's just about the same situation if you try to compare W6VSS with let's say W4TO: you just can't compare most of the strong boys with other strong ones from other call areas. I am still trying to figure which is best, height (W3CRA) and good ground conditions—or the sea coast (W5VA).

While working in Philadelphia I was taken out on a blind date by a friend and was introduced to a FB YL named Miss Agnes Smith. I immediately said to myself, THIS IS THE ONE! I decided to really go to work on the whole family. Their radio was in need of repairs so the next night I brought around some new tubes (probably donated by Philco!), cleaned up the volume control, really tuned it up, put up a good antenna and, boy, that old set really jumped. I was in FB with the whole family. I did not bother with asking

for dates from then on. I just said "Honey, I will see you tomorrow," and it ended up that I was over there almost every day and night. Somehow or other I just did not get on the air as much during that time; I spent nearly all my spare time with the Smiths–and Agnes. One day over at work I was asked by some fellow why I was not on the air very much and I told him about the YL QRM I was having–and he said, "Gus, why don't you marry her? Then you could get on the air again and work some of the good DX that's coming through." I thought this over and came to the conclusion that this would be a good solution to my problem. That same night I asked Agnes what she thought of us getting married, she said "Well, you are here every night anyway, so we may as well get married."

We were married a few months after that and settled down to our married life. I am sure I got the right one for a ham. Do any of you fellows know of any ham in the world whose wife would let him go on a 7 months DXpedition, then a 2 years DXpedition, fill up their house with radio gear, cover up their land with antennas? Do any of you boys have the XYL bring to the Ham Shack your breakfasts, dinners, and lunches? That's Peggy for you. She has never failed to do this for me when I ask her. I am sure I got the one and only perfect ham's wife.

I remember when we arrived in Orangeburg. We rented a small furnished room, and the old rig with the pair of 852's in push-pull was installed, taking up about half of the room. The old Zepp was put up and I was on the air with W4BPD, Orangeburg, S. C.

Finally the place where I was working for $7.00 a week went broke. Then I started this business of house to house radio service. This continued for a few years and soon I decided to rent a small place and go in business for myself with Peggy as the bookkeeper. About this time I bought myself a small lot on the outskirts of town and built a house. During those days I was a strong 160 meter fellow; even put up a ¼ wave vertical and came nearly winning a few WAS contests on 160. I was still very much interested in working real DX and the only good long-wire antenna I could get up had to cross a neighbors back yard to get to a tall pine tree. This old long-wire was good and was at just the right angle to put a good signal into Asia.

Things went very fine for a few years until that man whose lot my long-wire crossed told me one day that he did not like my antenna crossing his land. I told my wife about this calamity to my DX hamming and told her it looked like we would have to buy ourselves a farm. She said it would be OK with her. That same day I went down and opened up my shop. Daily in Orangeburg the business people take what we call a Coke break at about 10 o'clock, so down to the drug-store soda fountain meeting place I went for my Coke break. While there talking to the boys and drinking Cokes and eating Nabs, a friend of mine came in who owned a 152 acre farm about 6 miles from town. He was sort of feeling low and I asked him what was wrong and he said he needed some money. Is asked him how about selling me his farm and he said OK, mentioning a very, very good price. I said OK, I would buy it if he would sell it to me this very morning. He agreed so down to my lawyer we both went and in a matter of an hour or two the farm was mine. Back I came to my little hole in the wall and said "Honey we got ourselves a farm." She, without blinking her eyes once, said, "That sure is fine, where is it?" I told here and we closed up shop and went to see our new bought farm. (Boys, ain't that a wife for you?) We both were delighted. Peggy liked the house on the farm, and I could just picture the whole place all covered up with Rhombics, V's, Long wires, etc.

We moved in and I immediately proceeded to build a nice big ham shack on the rear of the house. This was a real Ham Shack measuring 24 ft. by 48 ft., and upstairs I even built 3 bedrooms for the children. Oh yes, Peggy and I had been busy and had 4 children by then.

I spent the next 3 or 4 months with a survey transit and Jeep laying out Rhombics. Then then next month in the cypress swamps cutting cypress poles for the antennas. 12 rhombics were laid out and finally installed. The shortest was 750 ft. from end to end. The longest 1750 ft. from end to end–on AC4-land for long path, and another on AC4 Short path that was about 1300 ft. from end to end. All antennas were terminated into Ward-Leonard Non-Inductive 750 ohm resistors. All of this antenna business was done during the War, taking about 2 years of hard work. All poles were over 66 ft. high; a few over 85 ft. high. The war was still going on so I had a few more years to kill. Then I built and built and built. By the time the war ended I had ready to go 6 transmitters, each one a K.W. input, 12 Rhombics, a 80 meter vertical, a 16 element Sterba curtain and even a few half wave doublets. I was ready to go when we were told that we could again operate.

With antennas I found that the 16 element

Sterba was just as good as a rhombic. Regarding the angle of coverage of a rhombic, I had one rhombic centered on Casa Blanca and one on Berlin. This places HZ1AB in Saudi Arabia in the exact center of these two rhombics. Both rhombics gave the exact same signal from HZ1AB. But the Sterba curtain which was centered on HZ1AB gave two S-points *increase* in signal strength. Then I put up a good rhombic on HZ1AB, making rhombic number 13 that I had in the air. I found that this number 13 rhombic gave the exact same signal from HZ1AB as the big Sterba. Some other conclusions about rhombics is that they *seem* to be terminated even when there is no terminating resistor on them. I had one rhombic centered on New Guinea—and another one pointing exactly the other way. With no terminating resistor on either one of them, the one pointing at New Guinea was always the best by at least two S-points. This was proven to me any number of other times with other rhombics. As far as tuning them up I never could see any difference whether the terminating resistor was connected or not. If I were putting up a rhombic tomorrow I would not bother terminating it. I would point it at the station I wanted to work, and that would be that. I once put up about 6 V beams which proved to be pretty good. But with V's just as much signal goes out of the back that goes out of the front! With all these antennas, plenty of power and a reasonable amount of time to hunt DX, and beating my brains out, I did manage to be number 4 in the new DXCC.

I began to study the habits of the DX stations, watching their operating hours, reading any and all DX bulletins. I began to chase DX seriously. I found out that if you want to really get a high country total that you stop all rag chewing, you only work a country until you get a QSL, you sneak home during working hours, you run high power, you have up the very best antenna your pocket book will stand and when you work that new one you go all out to get his QSL card. One of the secrets of those high country total boys is getting that QSL card.

My method was like this: First I sent a regular QSL card with a few IRCs, wait 6 weeks, then I send another QSL card and a letter and a $1.00 bill, then wait 4 weeks. Then I sent the following . . . a very nice long letter, a $5.00 bill, 10 IRCs, a batch of photos, and a home-made QSL card all filled out, with a stamp attached with Dupont Cement. All he had to do was just sign his name to the card. This last one always did the trick—that is, when you know the fellow's proper address; without that you can be stuck. Unless like I did—I found or rather ran across, FI8AA in France, he had his log, my call was in it and he gave me the QSL direct! I now know the address of AC4NC up in Sikkim and will go to work on him before I depart from this area. (At the moment, I am sitting in a hotel room in Calcutta writing this.)

I was down at my shop working one morning and a fellow stopped by to see me. He introduced himself as Frank Lucas and said his call sign was W3CRA, Frank even got married in Orangeburg and I was Best Man at his wedding! Then Frank and Vicky stayed with us for about 2 or 3 months helping me at the shop and working DX every night and morning. I remember one morning I came into the shack and Frank said he was working YI2CA. I picked up the second pair of phones and all I could hear was mostly background noise and static with a very weak signal in under the noise. I could never even make out the call sign but here was Frank copying the fellows name and address and he told me that YI2CA said that this was his first USA QSO. When Frank signed off I said, "Ah come on Frank don't pull my leg! You did not have a QSO with anyone. You are trying to kid me!" Frank said "Gus you wait and see because this fellow said he would send you an air mail QSL direct and immediately." SURE ENOUGH in about 4 or 5 days a QSL came and on it were the words Direct USA QSO! I thought I was pretty good at copying the weak ones but Frank had me beat a long ways. Evidently Frank must have built in noise and QRN filters in his ears! Oh yes, does anyone know of any other ham in the world who has 3½ inch rigid copper with gas under pressure for their feed line? That's what W3CRA is using—I have seen it—maybe that's what helps that signal of his.

While working DX and listening to some of their operating and listening to them give their name, address, power, antenna etc. I have often said to myself boy, how I wish I were on the other end. In fact I made a list of DON'TS that I would practice if I were ever DX! The list became quite long after a number of years. I had no idea that I would ever be able to benefit from that list. Here I was in a small Southern town, trying to raise 4 children, up to my ears in debt, just bearly half-way making ends meet—and thinking about a DXpedition! Boy, how crazy can a fellow be anyway? Wait until this story unfolds—the impossible finally did happen—.

. . . Gus

Robert D. Corbett W1JJ
46 Prospect St.
Torrington, Conn.

Interlaced Sync Generator for Ham TV

This unit was designed with the following points in mind: low cost, stability, simplicity, low power drain and ease of adjustment. The total cost turned out to be approximately $20 with all new parts. The unit is stable. It will hold adjustment for many weeks at a time. Power drain is a total of .455 watts, or about half what it takes to run a #47 pilot light.

The basic 31.5 kc saw-tooth oscillator employs a 2N2160 uni-junction transistor. A regular transistor will not work in this circuit.

The divider circuits are not the usual locked multivibrator or blocking oscillator type, but employ a pulse counting system known as the stairstep method. In the partial diagram (Fig. 1) resistor R1 sets the amount of voltage each pulse from the preceding stage applies to the base of transistor Q1. This varies the amount of voltage applied to C1 by each pulse. Each pulse adds to the voltage applied to C1 until the voltage discharge point of Q2 is reached. At this point one pulse is delivered to the input of the next counter through C2. From this it can be seen that there is little chance of any stage getting out of step. Any slight drift of the 31.5 kc oscillator will have little effect on the interlace.

Three of these dividers are used to arrive at the vertical scanning rate of 60 cps. The first divides the 31.5 kc oscillator frequency by 15 The second divides this by 7, and the third by 5. Thus a total division of 525 is provided in only three stages. The fourth and last divider takes the basic oscillator frequency and divides it by two to arrive at the horizontal scanning rate of 15,750.

A total of nine transistors, 11 resistors, 10 small capacitors and five potentiometers are used. Two small diodes are used to help shape the output pulse and remove any slight ripple that may leak through from preceding stages.

Construction of the sync generator is simple. Layout is not critical, and wiring may be point to point with most of it done with the leads of the various components. I do advise the use of sockets for the transistors though. Neatness counts only to the extent of your pride in workmanship and ease of future servicing. I have built two of these units so far, one wired conventionally and the other on a printed circuit board. No difference in operation was noted.

Adjustment

The easiest way to adjust the generator is with an oscilloscope. First connect the input of the scope to the oscillator test point (TP 1). Set the sweep rate at 15,750 cps. Adjust the

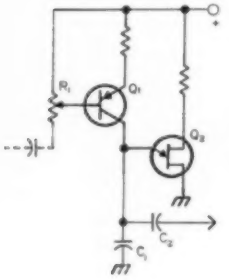


Fig. 1. Stairstep pulse converter.

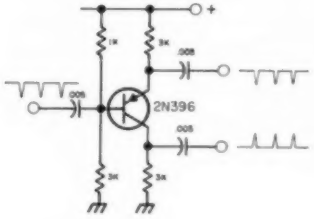


Fig. 2. Phase inverter.

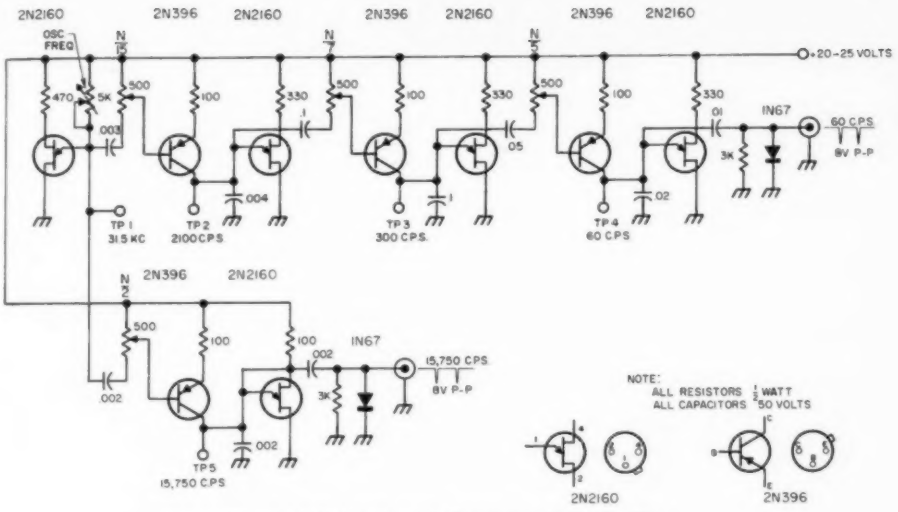


Fig. 3. Interlaced sync Generator for ham TV.

oscillator frequency control until two complete cycles are observed on the screen. This indicates that the oscillator frequency is set at 31.5 kcs. The scope input should then be connected to the test point for the first divider (TP 2) and the sweep rate adjusted to 2100 cps. Adjust the control for the first divider until 15 steps are seen. This same system is employed for the next stage with the sweep rate set at 300 cps and its control set for 7 steps as checked at TP3. Continue on to the last divider in this string with the sweep rate set at 60 cps and 5 steps. The final adjustment is to set the scope rate to 15,750 and connected to TP4. Adjust this dividers control for two steps.

With the addition of two transistors and a few parts it is possible to have both positive and negative sync pulses available. These phase inverters are shown in Fig. 2. Both are identical.

The unit performs up to expectations and has worked well at W1JJL.

. . . W1JJL

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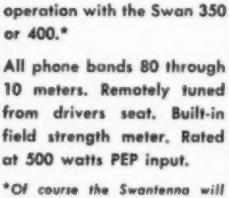

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Oceanside, California

Bob Schumacher WA9A
1556 Juneway Terrace
Chicago, Ill.

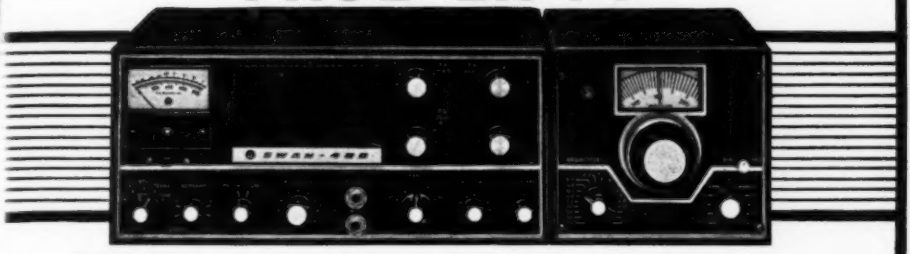
Fixed or Mobile?

You might call us fixed, but we consider ourselves mobile. These two words, "fixed" and "mobile," as used by those special breed of "Hamoids" denote whether or not the receiver-transmitter combo is located at one specific location or whether it has the potential of getting around as in a car, boat, or plane.

But herein, the words "fixed" or "mobile" connote a further meaning to a small group of devoted traffic handlers, ragchewers, CW addicts, et al. who have one thing in common; they are all physically disabled.

The era of the so-called shut-in is gone, as today there are thousands of active amateur radio operators who for some reason or another are disabled, yet these people with their polio, blindness, cerebral palsy, arthritis, muscular dystrophy and a host of other afflictions have unshackled themselves from their "fixed" position and are "mobiling" themslves around the world by means of radio communication. Though physically tied to their iron lungs, wheelchairs, hospital beds, walkers, and crutches, these men and women, boys and girls, have found mobility in their lives. The days of loneliness, boredom, and stagnation have turned to fruitful stimulating days of adventure and creativity for these people. Emergency traffic, public assistance, DX'ing, certificate hunting, or just socializing on the air has given them a new meaning in life. There are even handicap nets and clubs, such as the International Handicappers' Net and the Radio Amateur Invalid & Bedfast Club (to name two). A few of the VA hospitals are equipped with amateur radio gear and some

FACE LIFT?



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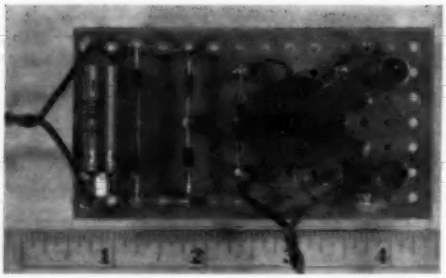
of the patients are licensed operators, while others are striving for their Novice tickets.

The hobby has become a tremendous means of combating the psychological and sociological disillusionments and embitterments of the newly disabled. Hamming indirectly helps to erase egocentric views and at the same time enlarges the individual's *Weltanschauung* (worldly views). It helps the disabled to make new friends not only in his or her community but also in all parts of the world, without even trying. Of course, it's not the panacea of all ills, but it is definitely an agreeable form of therapy (some of the medical people refer to amateur radio as a social or occupational therapy.)

How does a handicapped person get into this hobby? Mainly by studying and by contacting a ham in his or her neighborhood for guidance. Studies should consist of basic electricity and electronics. Libraries contain excellent selections. Bibliographies are available in most electronic catalogs (free for the asking, in most cases). As for guidance, the handicapped individual will be utterly amazed as to the willingness, friendliness, and cooperation his ham neighbor will offer. In fact, before he or she knows it, many other hams will be over to help. Once the amateur radio license is obtained from the F.C.C. (probably one of these same hams acted as the examiner), don't be surprised to see this same group over to help assemble the station and raise the antenna. Even if there is a loss of the use of the limbs, these ingenious part-time engineers will devise some mechanical or electrical gadget as a means for the handicapped person to operate completely and independently. Such gadgets as rubber hose with a metallic-leaf switch inside will activate or de-activate the transmitter when the disabled ham blows in the tube; or the micro-switch placed near the ham's eyebrow can open or lose the T-R relay by a simple closing of the eye; or the cooking spatula in the mouth for CW keying; or the audible tuning of the vfo by the blind operator; just to name a few of these aids. Above all, the disabled person will have made life-long friends during his orientation period and the list will grow over the years. It does take time and perseverance to get a license, but once the F.C.C. has issued you a call and permission to operate, one begins to re-live again.

Please excuse me now, as it's time for me to *Wheel* myself over to the shack as I have a "sched" with a bedfast OM and we hope to "mobile" around today.

. . . WA9AFI



A Compact DC-to-DC Converter

Hank Olson W6GXN
3780 Starr King Circle
Palo Alto, Calif.

Often it becomes desirable to include a single tube in an otherwise transistorized system for high-input-impedance, dynamic-range, or agc reasons. A case in point is in the rf front-end of a VHF mobile receiver, otherwise all transistors. It was found to be the least trouble in this receiver to use a single 6DS4 nuvistor as the first rf amplifier. This tube provided good agc characteristics, freedom from cross modulation, and low noise figure.

But supplying plate-voltage was a problem, because the commonly available converter units were for much larger power requirements. Ordinarily, the upper frequency of amateur dc to dc converters is limited by the transistor cutoff-frequency. With the less expensive germanium power transistors running at about one-fifth their cutoff-frequency, dc to dc converters sing out loudly at several kilocycles. (The "rule-of-thumb" seems to be to run the transistors at one-fifth their cutoff-frequency, so as to achieve fast rise time of the square wave.)

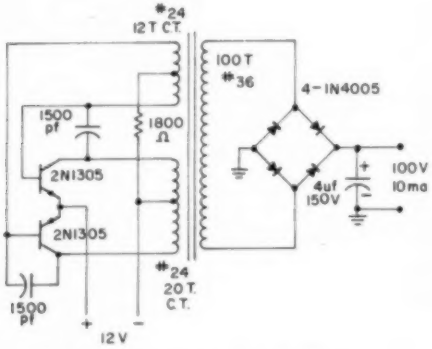


Fig. 1 Compact DC-to-DC Converter.

However, for this application we are not constrained to use germanium power transistors, since we wish to convert only a watt or two. For switching currents of this order there are many inexpensive germanium computer-transistors that have cutoff-frequencies of several megacycles. Now, it is the core-material that is the determining factor in limiting our frequency; and so we can almost immediately forget "C-cores" and tape-wound types. We are now in a good position to exploit the wonderful world of ferrite-cores, which will function on up into the megacycles. An additional bonus presented to us by the ferrite manufacturers is that such cores are not only available in torroid forms but in pot-core forms which are much easier to wind. The combination of pot-core form (where one simply winds a small plastic bobbin right from the wire spool, with no shuttle needed) and high frequency operation (few turns are needed), really makes this an easy job.

The converter to be described runs at about 20 kc, meaning that the job of filtering, after the rectifier, is simplified. Further, the 20 kc note, due to any magnetostriction, is above audibility and shouldn't bother anyone but the family dog. The circuit is shown in Fig. 1; note the 1500 mmfd de-spiking capacitors (yes the de-spiking capacitors get smaller too as operating frequency goes up). The unit uses 2N1305's and 1N4005's for a total semiconductor cost of about $3.50. The core with bobbin was obtained locally at a surplus electronics dealer* but a standard Indiana

* Red Johnson Electronics, 3311 Park Blvd., Palo Alto, Calif.

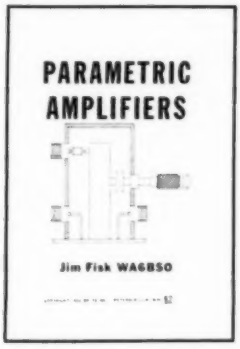
General pot-core such as a CF214-H could be used. The local cost with bobbin was about a dollar; which is probably the better way for an individual to buy the cores as the manufacturer and his representatives have a "$10 minimum order" policy. The circuit-board unit is shown in the photo and could be "compacted" into a few cubic inches for those with tight mobile-space requirements.

The primary windings were wound on the bobbin first although with the "completely closed" magnetic configuration of the pot-core construction it probably is not critical which winding goes on first. The secondary was then wound over the others and taped with ordinary scotch tape. The windings were all hand-wound which took only a few minutes. No winding care is necessary as the bobbin is far from being filled up. The pot-core halves are held compressed together by a 6-32 nylon screw and nut and the eight wires brought out the various holes in the core.

The unit runs about 60% efficient which isn't so great as dc to dc converters go but at this power level it is difficult (and also of small importance) to achieve more efficiency.

. . . W6GXN

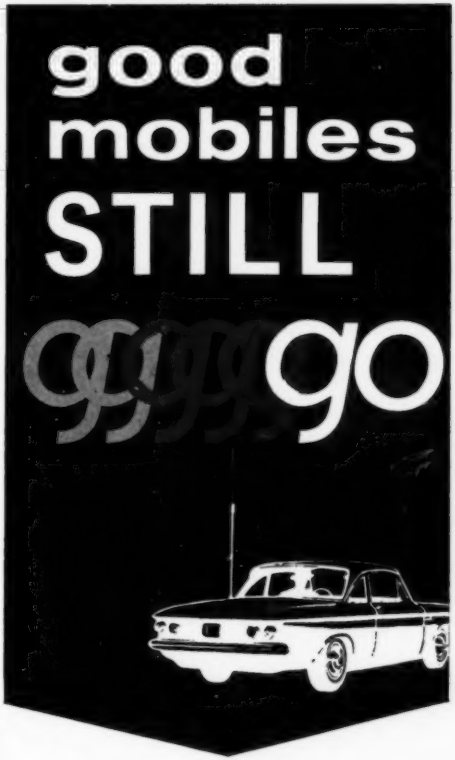
A New Book Published by 73



This book, the first on parametric amplifiers for the ham, is written for the average amateur and explains in simple language how they work, how to build your own for the various UHF bands, and how to tune them up. Parametrics have helped UHF move into the space age, but don't forget that the first working parametric amplifier was built by W1FZJ and worked on six meters.

Order this book direct, $2.00 postpaid, or from your local parts distributor.

73 Magazine Peterborough, N. H.



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Bill Roberts KØCE

Oscar Round-up

Reports from stations active during the OSCAR III experiment are beginning to drift in now. The following lists were compiled from logs submitted K4IXC, W4MNT, W8KAY, W8PT, K9AAJ, WØEYE (thanks fellows) and my own.

Active List

W1BU
HDQ
LMZ
QXX
JSM
YQI
DBT

K1LSY
K2GUG
IEJ
KJI
KJN
GUN
LMG
MWA/2
RCH
OJI
W2AZL
AMJ
LVQ
MHJ
AXU
WA2WEB
FSQ
YXS
W7PUA/2

K3KEO
W3BYF
SDZ
TDF

K5MBV
TQP
WXZ
W5AJG
NCE
UKQ
UJF
KXD
JWL
MGZ

K6HMS
HCP
DQJ
KV
GCD
TSK
W6AB
DEE
DCJ
GEO
KEV
MHS
TYM
MSG
UKQ
UXN
MGZ
WA6MNM
RLW
KLL
HTJ

JRG

K8AJF
W8FEH
NSH
YIO
KAY
PT
K9AAJ
AWP
UIF
W9CHU
PBP
ZIH
TGB
WND

KØCER
DOM
WØFNN
JRE
LER
MOX
NWX
EMS
ENC
IDY
EYE
TMO
IC
EOZ

LEE Gray K9AAJ, Quincy, Illinois. Western end of first 2-way QSO through Oscar III. Photo credit KHQA-TV.

K4IXC
MHS
QIF
YYJ
W4AWS
BUZ
MNT
WNH
MVB
NEE
IHK
HJQ

SLU
WB6JZJ
JZY
KAP

K7DZG
NII
BBO
ICW
W7LHL
UAB
OUE

VE7BGZ
LU3DCA
KL7GUH
W2UK/KH6
HB9RG
DL3YBA
EA4AI
VE3BQN
DIR
6NT
7NI
BNO

Thanks to K9AAJ, W4MNT, WØEYE, K4IXC. W8PT W8KAY

From these logs it was determined the following stations did make two-way contacts before the translator failed between orbits 206 and 214.

Worked List

Known 2-Way work was accomplished by the following stations

W1BU
W1HDQ

K2IEJ
K2MWA/2
K2GUG
WA2WEB

K4QIF
K4IXC
W4MNT
W4AWS
W4WNH

K5TQP
K5WXZ
W5KXD

W6KEV
W6TYM
W6MSG

W8FEH
W8NSH
W8KAY

K9AAJ
K9UIF

KØCER
WØIDY
WØEYE
WØNWX
WØLER

HB9RG
LU3DCA
DL3YBA

I am sure there were considerably more stations active and two-way work accomplished than these lists reflect. This, however, is what I know about at the time of this writing.

The HI and telemetry beacon became active again several days after both it and the translator quit. Several stations have reported the beacon active with a 12 second sequence. The 145.950 beacon never did function.

Additional orbital tracking data can be obtained from OSCAR Headquarters.

I understand the Project OSCAR Association and an east coast group are currently working on additional translator satellites with plans for

the launching of another later this year. More on this as it develops.

The general opinion seems to be that a fair amount of power, 500 watts or so, a low noise receiver and an array that could be tilted paid off for the largest share of operators. However, it is interesting to note that some stations were successful with less, both transmitting and receiving. VE7BGZ is one station for example. W9AAJ reports VE7BGZ heard him with a Rogers Majestic 5V into a BC-312 as a tunable IF and a ¾ wave ground plane. Several other stations reported similar results using dipoles and ¼ wave ground planes. Overhead passes were much better copy on a simple dipole or ground plane than on beams, as should be expected. This is where the ability to elevate the antenna paid off.

If you have not all ready done so, please send a copy of your OSCAR III report to the Project OSCAR Association. They need as much information as possible for use in planning future satellites. And while you are at it, send me a copy also.

This summer is a good time to prepare for the proposed fall launching of another translating satellite.

. . . KØCER

---

advised by my lawyers that
don't you ever proofread y
are a bunch of crooks and
have no other recourse but
should be tarred and feath

Letters

Dear Wayne:

The Richmond Amateur Radio Club has decided, as a project using the club call W4ZA, to sponsor a trip to Tangier Island. This is a four and one-half by one and one-half mile island in the upper Chesapeake Bay, with a population of 900 people. For the past fifteen years there has been a recurrent problem of supplying medical care to these citizens of Virginia. We, as a club, believe that a DXpedition to this island would publicize the need of medical care, accomplishing several things, not only for these needy people, but also for the club and for amateur radio. The Virginia Council of Health and Medical Care, a voluntary, privately supported foundation that supplies doctors to rural areas of Virginia, is enthusiastic about the program and they expect to have not only local but national coverage by such publications as "Life" magazine.

We will arrive on the island on June 18, 1965, and set up our transmitters, which will be from 80 through 2 meters sideband and CW. We will operate on the 19th of June for twenty-four hours, beginning at 8 a.m. Eastern Daylight Time, and we will return to the mainland on the 20th of June. Two other doctor hams and I will be in the group of approximately eight people. Our QSL cards will be titled "Tangier-CARE; Search for a physician for Tangier Island," and we will respond 100% to all QSL's. Our project has been cleared by the Richmond Academy of Medicine, so ethically the physicians on this trip will have medical support and encouragement.

Sincerely yours,
William F. Grigg, Jr., M.D. WA4AGB

Dear Wayne,

Belated congratulations to you, 73 and your various crusades. Undoubtedly you will be up to your elbows in this one: the March 31st FCC proposals. Your fluency and wit should dish up some lively prose on the subject.

My former friends Hiram Maxim, KBW, and Ross Hull are probably whirling in their graves at the goings on with ARRL brass. I am planning a protest proposal direct to the FCC and have received (naturally) hearty approval from all the other old timers.

John Murray W1BNN
Bloomfield, Connecticut

Dear ARRL Director (I hope),

Incentive licensing is necessary and just. The new FCC proposals suit me just fine, particularly call sign license grade identification. So there!

Cordially,
Earl Henson W3ZNF
Camden, Delaware

P.S. I take all three magazines. Yours, *Mad* and *Cracked*.

Dear Wayne,

There seems to be some misunderstanding about the power rating of the 1 KW PEP Amplifier described on page 6 in the April issue of "73." The pair of 811's can run 500 watts single tone (CW) input, however, the PEP with a single tone is the same as the average power which is 500 watts—not 1KW. The PEP is twice the average power only for a two-tone signal. Unfortunately, the amplifier cannot be run to 500 watts input with a two tone signal without severe flat topping.

The plate current for voice operation should reach 100 to 150 ma on peaks depending on the meter time constant. Talking up 350 ma peaks will most certainly result in splattering and bring down the wrath of the fraternity on the operator.

Wallace B. Kincaid WB2HZG
Rochester, N. Y.

Wayne:

You and Clif K6BX represent the lunatic fringe of ham radio. Who the hell do you think you are? Your I.O.A.R. is a money making scheme for you, representing 1/3 of 1% of U. S. Hams. Nuts like you will ruin ham radio with your insinuations, half-truths—distortions, egocentric ideas.

Your editorials are written for morons—anyone can see thru them, the biggest collection of LIES—LIES ever put forth.

Our Club has checked your so-called charges about A.R.R.L.—Huntoon, etc., and find you are a damned—publicity happy liar, everything for your own gain. Out here we would put you in a nut house.

ARRL FOREVER
YOU NUT,

Yakima Ham.
Washington

Dear Mr. Green,

I wonder when the first group complained to its government that the secret to how a bird flies was being kept from them?

From what evidence is available it seems obvious that some group has relatively complete control over the gravity situation. Why don't we make a start in this direction? Perhaps in your usual (or unusual) manner you have been hinting at this. 73 has probably the greatest collection of technical talent in the world as its readers.

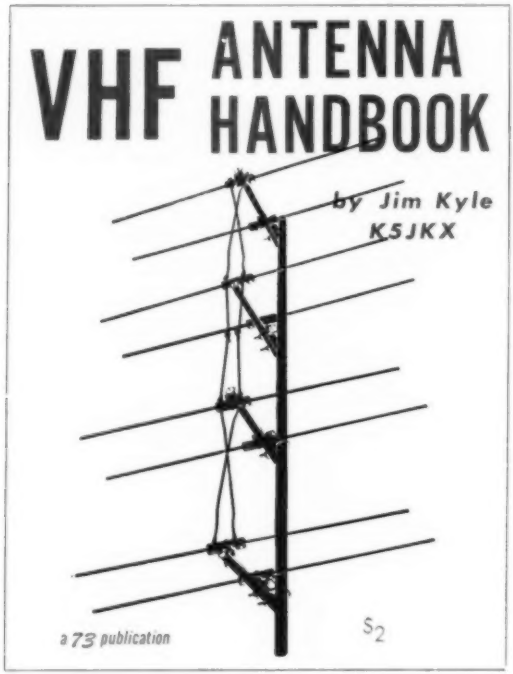
Here are a few of the problems not necessarily in order that could stand a little mulling:

Gravitational field oscillator (transmitter?); Oscillating gravitation field detector (receiver?); Velocity of gravitational field disturbance (faster than electromagnetic?) (Nobel Prize material here!); Resistors, capacitors, inductors, rectifiers, amplifiers, etc.; Local field control (as with electromagnetic fields at present).

To play around with these a moment, wouldn't it be funny if we found our friends in the UFOs using this system? Would amateurs be allowed "200 meters and down"? Would 73 publish data on working equipment in this area?

Bill Hounsel W5OUK
Refugio, Texas

It's Here!



The VHF Antenna Handbook

The VHF Antenna Handbook is your complete guide to VHF and UHF antennas. This outstanding book is by Jim Kyle K5JKX, one of the outstanding technical authors in the electronics field. The VHF Antenna Handbook covers complete theory and all practical details for every type of VHF and UHF antennas. A special feature is the commercial antenna catalog section. If you're interested in VHF, you should have this book.

Price is $2 from

73 Magazine
Peterborough, N. H.

73 HAMFEST

SUNDAY JULY 4
PETERBOROUGH, N. H.

73 is having a hamfest. It's going to be a real old fashioned hamfest with fun for all. There'll be no admission charge, no "donation" and no registration fee. Come to the beautiful Monadnock Region of New Ham Shire to meet us and have a pleasant day with all of your ham friends.

ACTIVITIES FOR ALL

Tremendous auction: Clean out all of that useless old junk. There'll be no charge and no commission. A special feature will be part of W2NSD's legendary collection for sale.

Antenna measuring contest: Prove that you can make (or buy . . .) a better antenna than everybody else. Find the true gain of your beam. Any horizontally polarized antenna for 2 or 432 that one person can hold is eligible. Have 10 feet of RG58 with a male BNC connector attached for the lead. Prizes and glory for the winner.

Homebrew contest: Bring that gear you've built and show it off. Separate judging for simple and complex equipment, gear built from 73 articles, and on neatness, originality, performance, etc. Prizes.

Two meter hidden transmitter hunt. A contest that belongs at every hamfest. Prizes for the winners.

Dealers: Surplus and other dealers with goodies for sale.

Technical talks and demonstrations by well-known hams and manufacturers.

Special bookshop sale. Unbelievable 73 subscription price. Back issue grab-bag.

73 Mountain and Pack Monadnock for fascinating VHF operation. Bring your portable and mobile gear. Open house at 73.

For the wife and kids: Nearby state parks and mountains with swimming and climbing. Antique shops. Beautiful scenery and pleasant driving. Have a picnic. Bring your food or buy some at nearby shops. Peterborough July 4th Parade and Revolutionary War program. Write to the Monadnock Region Association in Peterborough for information on inns, motels, parks, covered bridges, antique shops, tourist attractions, etc.

Protest meeting against docket 15928 at 3 pm.

10 A.M. Sunday, July 4th at the National Guard Armory three blocks west of the junction of routes 101 and 202 in Peterborough, N. H.
Y'all come.

Let Us Know If You're Coming.
73 Magazine, Peterborough, N. H.

Gerry Stephens W9SLM

A Surplus Sleeper

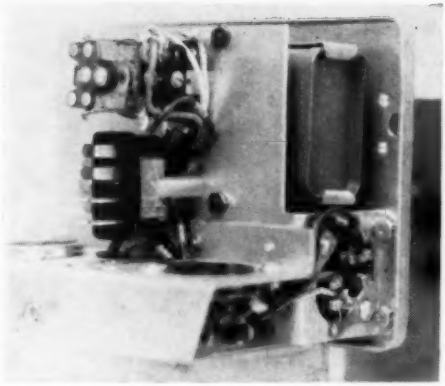
Having been addicted to "surplus" since about 1950, I have been known to dabble ("or mess around with that junk," as the XYL puts it) ever since. Many reams of paper have been written on modification and conversion of this gear to better fit the amateur needs. Like myself, many amateurs start out in the game with an ARC-5 transmitter and receiver.

Before going any further, let me say that this is not a conversion article. Rather, it is to familiarize you with a fine piece of gear that to my knowledge has not been featured in any previous article in the trade magazines.

The Packard-Bell Preamp, Model K, contains these parts:

- 1 6SL7
- 1 28D7
- 1 6 mfd @ 50 vdc condensor
- 1 mike input transformer
- 1 output transformer
- 1 DPDT 20 to 30 vdc relay
- 1 male & female 8-pin Jones plug
- 1 octal socket
- 1 locktal socket
- 13 ½ watt resistors
- 3 ceramic capacitors
- 1 four foot length, three conductor cord, terminated with a remote type hand switch.
- 1 20" length of three conductor cord
- 1 24" length of two conductor shielded cable
- 1 aluminum chassis (with appropriate holes hi hi)
- 1 15 gauge drawn aluminum case and panel

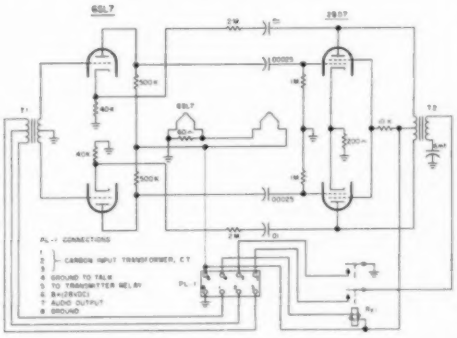
The inside dimensions of the cabinet are 3 23/32" high, 4 23/32" wide, by 3 11/32" deep. It is extremely "clean" as surplus goes, having only 6 small holes in the front panel. These holes are for the screws that fasten the chassis to the front panel and the panel to the case. The case has louvers on the top, and both sides. The cabinet is a natural finish aluminum with rounded corners and is quite pleasing in appearance. I have not seen a similar cabinet in any of the parts suppliers catalogs, and if one was available, I would guess that the price would be considerably more than this unit.



Without a doubt, this unit could be converted to a small PA amp, modulator, intercom, or other little goodie, but as I mentioned earlier, we will not deal with any specific conversion here. You build whatever you want with it. Some of the gear I have built is shown in the photos.

The schematic diagram shows the original circuit.

In case you need some ideas to fill up these little "dandy's," page through your back issues of 73. There are lots of things to construct. I have 5 or 6 more of these little units stuck away up in the attic, and I would imagine the next issue of 73 will have another Kyle special that I will want to build.



That's it fellas. I think it is a real gem even if you don't want any of the goodies tucked away inside the cabinet.

If you have trouble locating this unit in the surplus ads, try Arrow Electronics Inc., Chicago, Illinois. Their catalog number is 109AX17LT. Shipping weight is 2 lbs, and that price is $3.95 with tubes.

. . . W9SLM

photos by "Slim" Davis.

Surplus Frequencies

Ever run across some equipment with a designation but no indication of frequency coverage? Here is a list that should clear up some confusion.

Designation	Receiver range	Transmitter range	AM-FM
SCR-131	3.96-4.36	3.96-4.36	AM
SCR-161	4.37-5.10	4.37-5.10	AM
SCR-171	2.64-3.04	2.64-3.04	AM
SCR-177-A	0.4-1.0 and 1.5-4.5	0.4-0.8 and 1.5-4.5	AM
SCR-177-B	0.15-18.0	0.4-0.8 and 1.5-4.5	AM
SCR-178	2.4-3.7	2.4-3.7	AM
SCR-179	2.4-3.7	2.4-3.7	AM
SCR-188	0.4-13.0	1.5-12.5	AM
SCR-188-A	1.5-18.0	1.5-12.5	AM
SCR-193	1.5-18.0	1.5-4.5	AM
SCR-194	27.7-52.2	27.7-52.2	AM
SCR-195	52.8-65.8	52.8-65.8	AM
SCR-197	0.54-44.0 (Monitor Rec. 5-20-R)		AM
SCR-197	1.5-18.0	1.5-18.0	AM
SCR-203	2.1-3.1	2.2-3.06	AM
SCR-209	1.5-18.0	2.2-2.6	AM
SCR-210	1.5-18.0	-------	AM
SCR-245	1.5-18.0	2.0-5.25	AM
SCR-284	3.8-5.8	3.8-5.8	AM
SCR-288	2.3-6.5	3.5-6.3	AM
SCR-293	20.0-27.9	20.0-27.9	FM
SCR-294	20.0-27.9	-------	FM
SCR-298	30.0-40.0	30.0-40.0	FM
SCR-299	1.5-18.0	2.0-8.0	AM
SCR-299-F	1.5-18.0	2.0-12.0	AM
SCR-300	40.0-48.0	40.0-48.0	FM
SCR-399	1.5-18.0	2.0-18.0	AM
SCR-499	1.5-18.0	2.0-18.0	AM
SCR-506	2.0-6.0	2.0-4.5	AM
SCR-508	20.0-27.9	20.0-27.9	FM
SCR-509	20.0-27.9	20.0-27.9	FM
SCR-510	20.0-27.9	20.0-27.9	FM
SCR-511	2.0-6.0	2.0-6.0	AM
SCR-528	20.0-27.9	20.0-27.9	FM
SCR-536	3.5-6.0	3.5-6.0	AM
SCR-538	20.0-27.9	-------	FM
SCR-543	1.68-4.45	1.68-4.45	AM
SCR-593	2.0-6.0	-------	AM
SCR-608	27.0-38.9	27.0-38.9	FM
SCR-609	27.0-38.9	27.0-38.9	FM
SCR-610	27.0-38.9	27.0-38.9	FM
SCR-619	27.0-38.9	27.0-38.9	FM
SCR-624	100.0-156.0	100.0-156.0	AM
SCR-628	27.0-38.9	27.0-38.9	FM
SCR-694-AW	3.8-6.0	3.8-6.0	AM
SCR-694-C	3.8-6.5	3.8-6.5	AM
SCR-808	27.0-38.9	27.0-38.9	FM
SCR-828	27.0-38.9	27.0-38.9	FM
RC-256	100.0-156.0	-------	AM
RC-257	-------	100.0-156.0	AM
AN/CRC-3	30.0-40.0	30.0-40.0	FM
AN/TRC-1	70.0-100.0	70.0-100.0	FM
AN/TRC-3	70.0-100.0	70.0-100.0	FM
AN/TRC-4	70.0-100.0	70.0-100.0	FM
AN/TRC-8	230.0-250.0	230.0-250.0	FM
AN/TRC-11	230.0-250.0	230.0-250.0	FM
AN/TRC-12	230.0-250.0	230.0-250.0	FM
AN/VRC-1	1.5-18.0 and 100.0-156.0	3.0-62 and 100.0-156.0	AM
AN/VRC-3	40.0-48.0	40.0-48.0	FM

NOTE: Frequency ranges and type of emission are those specified in the relative TMs and TOs.

. . . WA6FTG

William C. Lewis WØCGQ
428 Concord Avenue
Boulder, Colorado

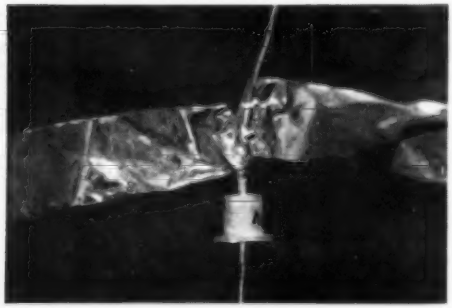
Kitchen Heat Sink

The accelerated development of solid state electronic devices in recent years has brought their cost within range of the budget of the average amateur radio operator. The result has been not unlike hanging a carrot in front of a hungry rabbit, and those amateurs who brew their own are finding that semiconductors have a lot to offer. Many times the first try at solid state construction has resulted in the hapless experience of overheating and damaging a semiconductor or in having to trace out bugs in the gear caused by cold solder connections. The cause of these problems is either too much heat applied to the component while soldering, or, in an attempt to keep the component cool, too little heat applied to the connection. The solution to this type of dilemma is the proper use of a heat sink while soldering in a particular semiconductor.

There are a number of heat sinks on the market today which are quite effective in most applications. The main problem with these seems to be that no matter how many types you may have in your toolbox, the one you have never fits the space available. The solution to the space problem is simple and the material is available in most kitchens.

A roll of the common garden variety aluminum cooking foil will make enough heat sinks for all the solid state construction the average ham will ever do. Cut into small strips and doubled where necessary, it a makes most efficient low cost heat dissipating device.

For diodes, capacitors and other heat sensitive components with long leads, cut a piece of foil about three inches long and a half inch wide. Take one turn around the lead to be soldered with this foil strip and pull the foil tight against itself. Be sure that there is a good tight physical contact between the foil strip and the lead. Leave the ends of the foil strip out away from the lead to act as radiators. When soldering a connection to a lead of a component with the foil attached, most of the heat normally radiated by the component itself will be dissipated by the foil strip.



The Kitchen Heat Sink.

When placing transistors in equipment, wrap a strip of foil around the body of the device to help keep the case temperature down during installation. This also would be a good idea if you found yourself running semiconductors near or slightly above ratings in experimental equipment. Always remember to keep the ends of the foil strips free to radiate heat to the surrounding air.

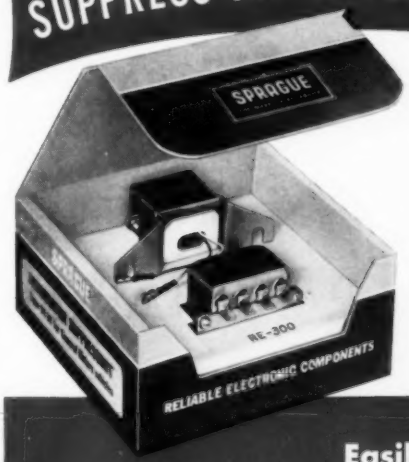
If you care to test the heat dissipating ability of this arrangement, wrap a piece of foil around a two inch piece of component lead in the manner explained above. Hold one end of the wire and apply a preheated 250 watt soldering iron to the other end. Although in time you will burn your fingers, you will find that even with this excessive amount of heat applied to the wire, it will take a fair amount of time for the wire to become so hot that you will have to drop it. I realize that this test is rather extreme and I certainly don't advocate the use of 250 watt soldering equipment in any semicondutor circuit work.

Although strong enough to be used well as heat sink material, foil can also be removed from tight corners quite easily as it will tear loose from a circuit board without component damage. I have installed it between a component and a circuit board to dissipate heat from a large area and when finished soldering in that area, I simply tore it away from the entire assembly. Folded into layers, it can be used as makeshift power transistor heat sinks.

There are many places where the heat dissipating properties of aluminum foil can be used to great advantage in the ham shack. Try it and see.

. . . WØCGQ

SUPPRESS RFI IN YOUR MOBILE RADIO GEAR!



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★ Designed to fit most newer vehicles through the 1965 model year. (for older vehicles, see the SK-1 Suppressikit, below.)

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Roy Pafenberg W4WKM
316 Stratford Avenue
Fairfax, Virginia

Converting the R-508/ARC

This later day VHF Command Set Receiver requires only minor modification for superior 2 meter performance.

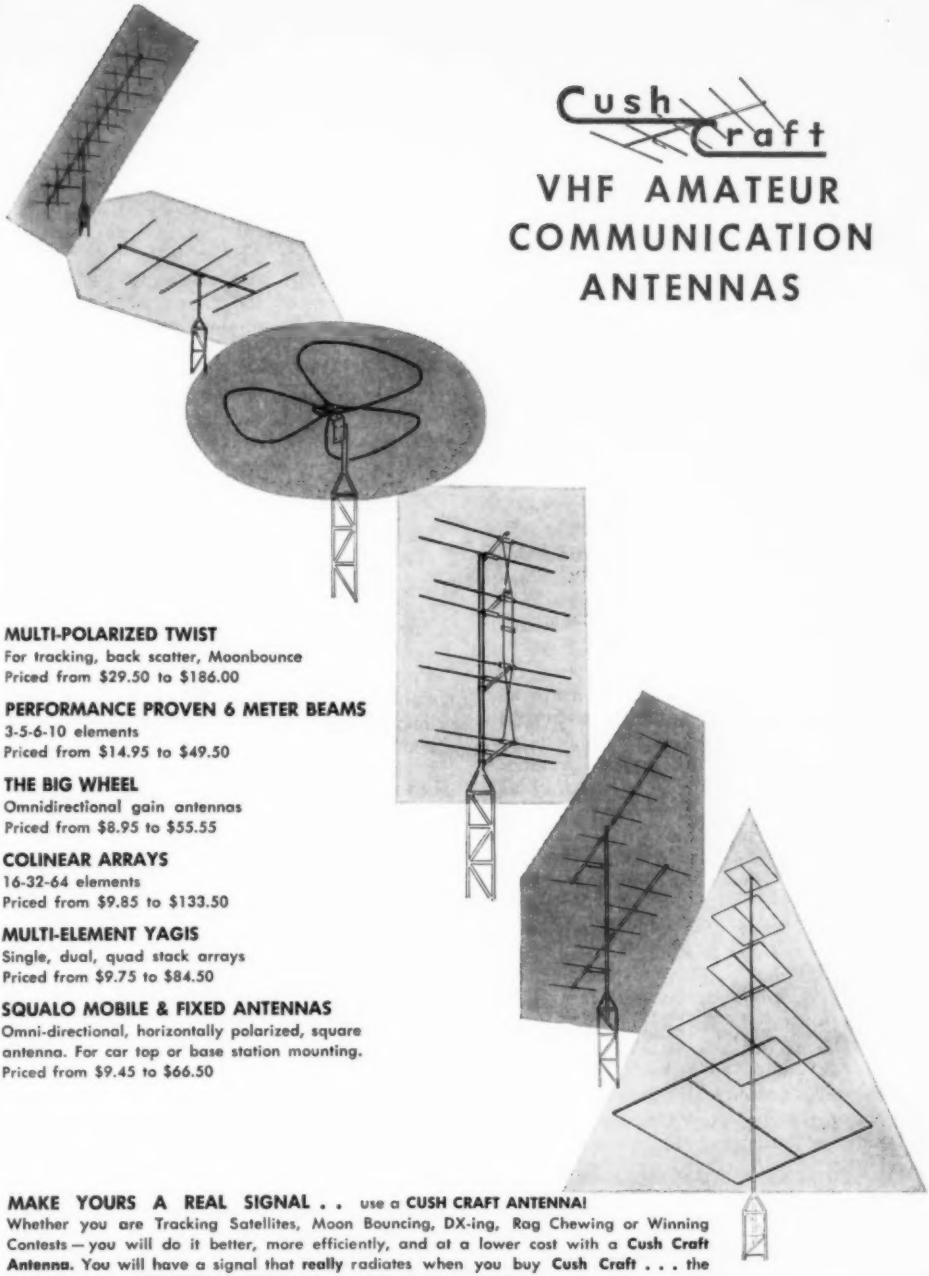
The R-508/ARC receiver is the 28 volt, military nomenclatured version of the Aircraft Radio Corporation R-19. The R-507/ARC is identical except that it is designed for operation from a 14 volt dc supply. Both resemble the older Command Set receivers except that no dial is provided and all connectors are mounted on the front panel. Frequency coverage is 118 to 148 mc in one continuous tuning band. A total of 9 tubes are used in a modern superheterodyne circuit which features 2 rf and 3 *if* stages, AGC, noise limiter, adjustable squelch and 2 stages of audio. Audio output is rated at 360 mw into a 300 ohm load. Sensitivity is better than 2 microvolts for 10 mw audio output and selectivity is 175 kc at 60 db down.

All that is required to convert these receivers to home station two meter use is to add a power supply, rf gain control, audio gain control and speaker. This conversion uses the power supply described in the earlier article (Sept. '63) and the description will not be duplicated here. This supply is constructed on the dynamotor mounting base and the filament, plate and ground terminals on the connector are unchanged. Remove the bottom plate from the receiver and set aside along with the hardware. Remove the mounting nuts from the three front panel power connectors, J-301, J-302 and J-303. Clip the red lead attached to Pin A of J-303 and pull through the wiring to where it terminates on C-331. Unsolder and discard the lead. Clip the red lead attached to Pin E of J-303 and pull through the chassis hole. Neatly dress this lead from where it terminates on C-343 to the terminal on C-331 from which the other red lead was removed and solder this connection. This step removes B+ from the power connectors and routes the B+ directly from Pin 3 of the dynamotor connector to the receiver plate circuits.

Clip out and discard the white lead running between Pin D of J-303 and Pin D of J-302. Clip the other white lead attached to pin D of J-302 and pull through the chassis to where this lead terminates on a terminal of L-310. Unsolder and discard this lead. Locate the white lead which runs from Pin 2 of the dynamotor connector to one terminal of C-334. Unsolder this lead from C-334 and solder to the now vacant terminal of L-310. Clip and discard the white lead running between Pin A of J-301 and Pin F of J-302. These steps remove the filament circuits from the front panel connectors and connects them directly to Pin 2 of the dynamotor connector.

Cush Craft

VHF AMATEUR COMMUNICATION ANTENNAS



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Whether you are Tracking Satellites, Moon Bouncing, DX-ing, Rag Chewing or Winning Contests — you will do it better, more efficiently, and at a lower cost with a **Cush Craft Antenna.** You will have a signal that **really** radiates when you buy **Cush Craft . . . the** antennas with a **"PATTERN OF FIRSTS"** in Amateur Communications.

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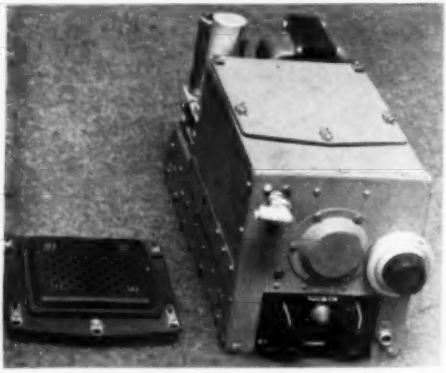

Converted receiver.

Clip from Pin B of J-301 the black lead which runs to C-331. Dress this lead out of the way for future ground connection. Clip from Pin C of J-302 the black lead which runs to Pin B of J-301. Discard this lead along with J-301 and C-301. Unsolder from Pin C of J-302 the black lead which runs to R-351, the squelch control, and dress the lead out of the way for future ground connection. Unsolder the two black leads and the sensitivity control ceramic bypass capacitor from the ground lug of the phone jack. Clip these leads from where they terminate on Pin C of J-302 and Pin C of J-303, discarding leads. Clip the green lead and bypass capacitor from Pin E of J-302, discarding the capacitor and dressing the green lead aside for future connection to the rf gain control. Unsolder from the the phone jack the two brown leads which run to Pin A of J-302 and Pin B of J-303. Clip these leads from the connectors and discard along with J-303. Clip the green lead from Pin B of J-302, discarding J-302. Clip but do not solder this green lead to the now vacant ground lug of the phone jack.

Remove the receiver mounting angle from the bottom front of the receiver, discarding the angle and retaining the mounting screws. Loosen the squelch control and fold back out of the way. Cut a 1⅞" x 3⅜" rectangle of sheet aluminum stock. Place the plate over the bottom of the front panel and scribe the location of the squelch control, the former mounting angle mounting holes and the two bottom connectors. Symetrically locate two ⅜" holes to fall within the area of the ex-connector holes for installation of the audio and rf gain controls. Drill all holes in the plate, deburr the holes and apply a couple of coats of spray lacquer. Mount the plate using the former mounting angle screws and the squelch control to hold it in place.

Mount a 50,000 ohm, 2 watt potentiometer in the left hand clearance hole and a 1 megohm, audio taper control in the right hand clearance hole. Terminate the two free black leads running to C-331 and R-351 on the ground terminal of the audio gain control. Run a lead from this point to the ground terminal of the rf gain control and hence to the ground lug of the phone jack, soldering all connections. Solder the green lead formerly removed from Pin E of J-302 to the other terminal of the rf gain control. Remove R-347, the audio output stage grid resistor, and wire the audio gain control using shielded lead with the center connector going to Pin 5 of V-309 and the top going to C-363. Ground the bottom. Install knobs on the new controls and decals as desired.

Either phones or an external speaker with a 300 ohm matching transformer may be patched into the phone jack. Alternatively a speaker may be used. The technique is shown in the photographs of the Command Set top cover.

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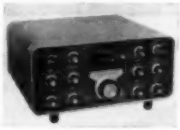

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. . . W4WKM

Note: a full schematic of the R-508/ARC is available from 73 for 50c.

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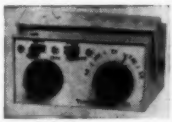

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★ Small size 2 x 2⅞" fits anywhere
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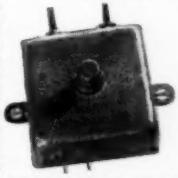

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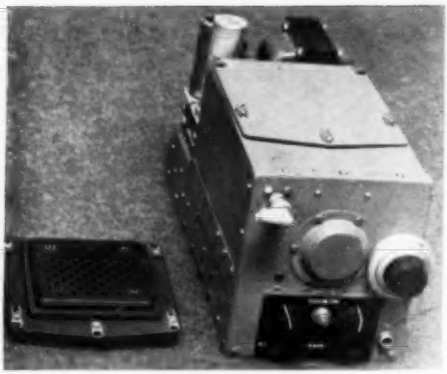
Pasadena, California



Converted receiver.

Clip from Pin B of J-301 the black lead which runs to C-331. Dress this lead out of the way for future ground connection. Clip from Pin C of J-302 the black lead which runs to Pin B of J-301. Discard this lead along with J-301 and C-301. Unsolder from Pin C of J-302 the black lead which runs to R-351, the squelch control, and dress the lead out of the way for future ground connection. Unsolder the two black leads and the sensitivity control ceramic bypass capacitor from the ground lug of the phone jack. Clip these leads from where they terminate on Pin C of J-302 and Pin C of J-303, discarding leads. Clip the green lead and bypass capacitor from Pin E of J-302, discarding the capacitor and dressing the green lead aside for future connection to the rf gain control. Unsolder from the the phone jack the two brown leads which run to Pin A of J-302 and Pin B of J-303. Clip these leads from the connectors and discard along with J-303. Clip the green lead from Pin B of J-302, discarding J-302. Clip but do not solder this green lead to the now vacant ground lug of the phone jack.

Remove the receiver mounting angle from the bottom front of the receiver, discarding the angle and retaining the mounting screws. Loosen the squelch control and fold back out of the way. Cut a 1⅞" x 3⅜" rectangle of sheet aluminum stock. Place the plate over the bottom of the front panel and scribe the location of the squelch control, the former mounting angle mounting holes and the two bottom connectors. Symetrically locate two ⅜" holes to fall within the area of the ex-connector holes for installation of the audio and rf gain controls. Drill all holes in the plate, deburr the holes and apply a couple of coats of spray lacquer. Mount the plate using the former mounting angle screws and the squelch control to hold it in place.

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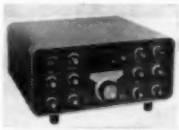

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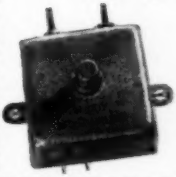

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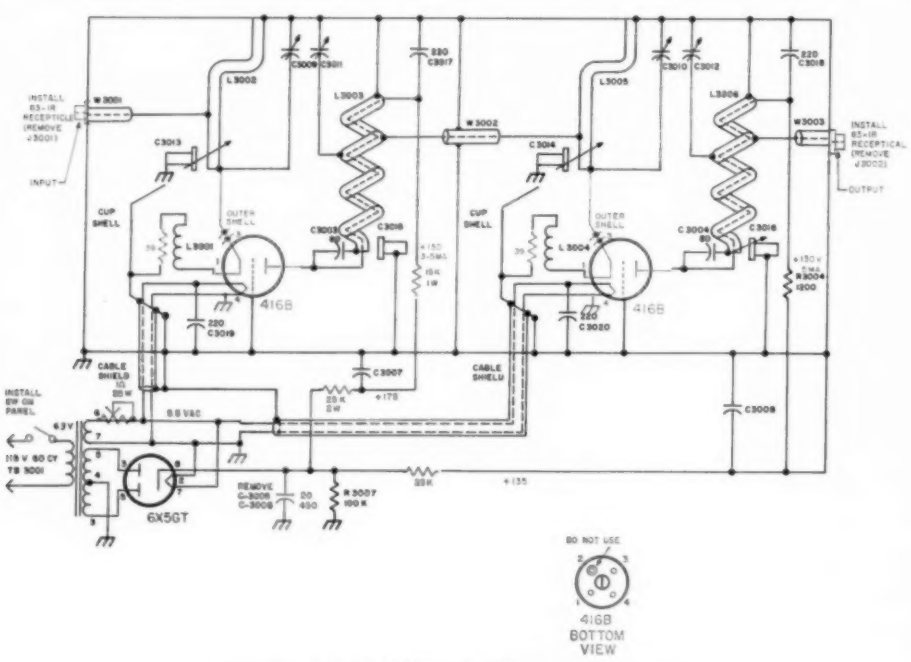
Converting the CG-50ABM

Photos by Jim Dungan, Dallas

Using the 416B on 220 mc

In 73 Magazine for June 1964, details were given for converting the Navy type CFN-416B planar triode tube in place of the original 446A or 2C40 types. Since this conversion resulted in a very worthwhile improvement in the equipment, it was thought advantageous to apply the same treatment to a somewhat similar piece of gear, now reposing in the attic this time covering the range of 220 mc instead of the 432 mc assignment.



Conversion of CG-50ABM. Modifications are in red.

The Navy Type CG-50ABM (or the 602-A1, or the BC1284) Preamplifier built by the General Electric Company, consists of a two-stage tuned radio frequency amplifier originally using the 446 series lighthouse tubes, and covers the frequency range from 175 to 230 mc. It was originally used to beef up the efficiency of the SCR-602 Radar set. Available in surplus as early as 1946, the CG-50ABM was converted to 144 mc use as well as being used on 220 mc (See *CQ* magazine for March 1947). The 446 type tube was the top performer in those days, as far as N/F and gain at 220 mc and up. When better tubes became available for 144 mc, this set was pushed aside a bit, and until the 416B became generally available to the 220 mc man, the CG-50ABM continued to see service on the 220 mc band. It will now be adapted to this 416B and as such will become a pretty good item at these frequencies. No changes will be required to tune the 220-225 mc assignment except to substitute the newer planar triode tubes for the originally installed type. A built-in 115 vac source is included and makes this box ideal for the job. The pre-amplifier is the "grounded-grid" type using flat-plate inductors and variable capacitance tuning elements, which of course eliminates any neutralizing problems, even though triodes are being used. Since the 446 type lighthouse tube is of a different total length physically from the 416B tube a little improvising will be necessary to make the tube fit in the original socket.

Once the tube mounting problem is solved, then the electrode voltages will have to be slightly modified. This is easily done by changing the values of a couple of resistors and full details will be shown by referring to the modified schematic. A couple of photographs will also help in the description. By lowering electrode voltages a bit on the 416B's, we eliminate the necessity of blowing air on the seals of the tubes. This has all been covered in the aforementioned mentioned article as well as the method of testing after the conversion is completed. Please refer to this article as some of the more practical pertinent points concerned will not be recounted here.

Modifications

The first order of business is the physical mounting of the new 416B tubes. Since both stages are identical in construction, the description to follow will refer to one tube only. Merely repeat the work for the second tube.

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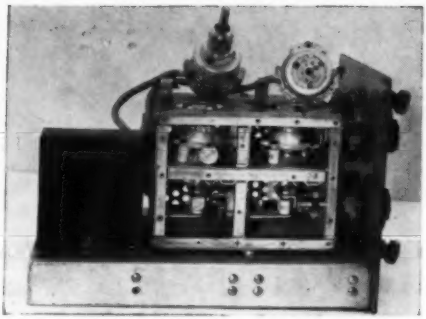

Side view of preamplifier.

Referring to the left side view photo of the completed unit with one of the sides off the rf box, it may be seen that the cathode connector portion of the original socket has been inverted on the socket stand-off insulators. This will allow the cathode shell of the 416B to snugly fit in the spring brass silver plated fingers. Now the circular grid-connector disc of material carrying the fingers to ground the 446 type tube is bent upwards a bit and will now engage the grid portion of the 416B, effectively grounding this tube also.

The only thing now remaining is to extend the plate connection of the 416B to fit into the fingers that formerly engaged the 446 plate. This is done just like the previously related arrangement in the 432 mc receiver article. A piece of ¼ inch copper tubing approximately ⅝ inch long is slit at one end and slips over the plate connection of the 416B. The other end of the tubing will now fit into the plate connector assembly of the socket.

Now that the tube is mounted, the tube socket case, above deck, containing the octal socket and other component parts of the 446 tube will be removed and this assembly will be modified by mounting a standard 416B socket. A new cathode resistor of 39 ohms will be installed therein as well as the original rf choke and by-pass capacitor. The exact way these few parts are mounted within the shell is of no great importance.

In summary then, the following parts are to be changed out or modified;

Cathode resistors R-3001 and R-3002, to be changed to a value of 39 ohms.
Resistors R-3005 and R-3006 to be changed to a value of 25K.
Resistor R-3003 changed to a value of 15K

The above new values installed in the E plus line will place the correct voltage of 130 volts on the 416B tube plates.

Further proceed;

Remove filter capacitors C-3005 and C- unit (electrolytic). Actually it is not strictly necessary to remove these capacitors, but it will be much easier to service the unit later on if they are eliminated and something more compact mounted under the chassis used, such as the electrolytic.

In order to drop the heater voltage from 6.3 vac to approximately 5.5 vac, install a 25 watt, 1 ohm variable resistor. Adjust for proper voltage. Also for convenience, install an off-on toggle switch on the front panel to take care of the 115v ac. The original equipment performed this function at some other point in the receiving system.

It will also be wise to provide a few ventilating holes in the two sides of the rf box to allow circulation of air to the 416B's.

The last item will be to change out the "odd-ball" rf input and output connectors that come on the CG-50ABM. If you should have mating plugs for these connectors, fine—but

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if you don't, these may be replaced with ordinary 83-1R receptacles to fit conventional PL-259 coax plugs.

Tuning Up

Due to the increased input capacitance of the 416B tube, it will be noted that the cathode tuning capacitors will tend to mesh with less effective capacity in the circuit, but the 220-225 mc band is amply covered. Unlike the 432 mc job previously discussed in the 73 article, this one will actually tune in the cathode circuits, due to the lower frequency involved and a bit less effective loading exhibited. On this lower frequency of 220 mc, a pretty good preliminary tune job can be done by peaking up on outside ignition noise (not tube noise). Turn off the ANL of the receiver *if* strip being used and adjust all front panel tuning controls as well as the trimmers C-3014 and C-3016 on the left of the CG-50ABM box.

Nothing was gained at this frequency on this unit by tapping in the antenna closer to the 416B cathode point than the original "tapped-down" location. As for results on 220 mc, a distinct improvement will be noted in the S/N department with the 416B's as compared to the 446A's. Other than that, it will depend on just how good your present 220 mc converter is when used alone. A rather remarkable improvement of from 6 to 10 db in S/N ratio, as well as a gain of from 16 to 20 db may be shown if the associated 220 mc converter is just so-so, or perhaps possesses a rather poor noise figure. However, if one is using a converter with a good rated input tube at this frequency and the overall operation of the unit is quite good as to N/F, then of course, the two stage 416B preamplifier will not show such spectacular results.

Regardless, even under such conditions as these, the additional gain and added selectivity will certainly be present to a greater degree than formerly. If the existing converter is a broad-band device, peaking the pre-amplifier tuning as one moves a half megacycle or so across the band, will now be necessary.

In some locations around the country, operation at 220 mc brings with it converter problems associated with spurious beat TV-FM type signals, in which case the additional selectivity afforded by the tuned 416B preamplifier should prove very useful.

At any rate, after using such modified gear with 416B tubes, vhf-uhf operators will have something to compare against when the step to parametric amplifiers is taken.

. . . W5AJG

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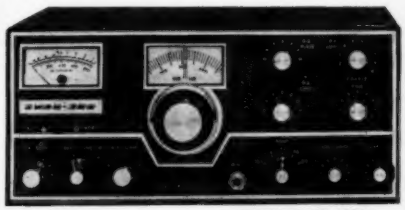

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Roger Smith K4PFK

High Power with an ART-13

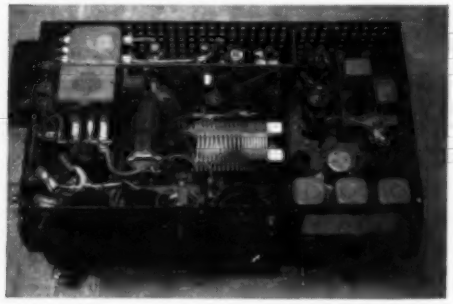
As most surplus-minded amateurs know, the ART-13 (and its Naval counterpart, the ATC) is a Collins autotune transmitter designed for operation mainly between 2 and 18.1 mc. In service, they drew their power from a 28 volt dynamotor which produced DC voltages of 450, 750, and 1150. The medium voltage was used on the 813 and 811's at high altitude while the highest one was used at altitudes less than 25,000 feet. The most amazing feature about this transmitter is the 11 channel autotune system. You may preset all of the 11 channels anywhere within the transmitter's frequency spectrum. The autotune motor derived its power from the same 28 volt battery that ran the dynamotor. About 25 seconds are required for the transmitter to switch a channel.

The ART-13 sells for between $40 to $80 depending on where you get it and its condition. Most of the conversion articles that I have read concerning this unit are for putting it on the air in a more or less original condition with little done to the rig other than constructing a power supply for about 200 watts input or so. I ran my ART-13 for 6 months at this power before deciding to soup it up to half a gallon.

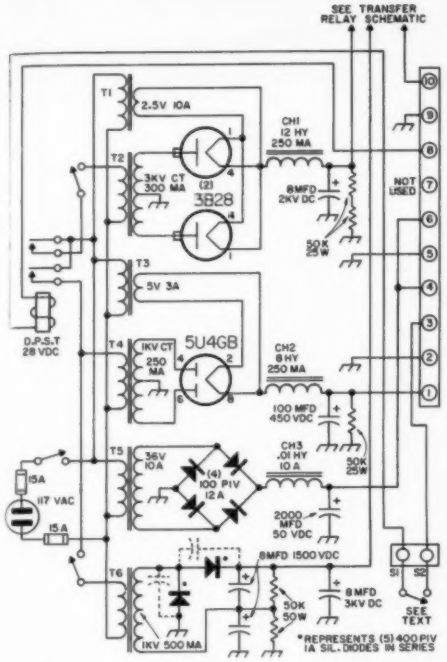
As a general rule, the 28 volt supply is usually the most difficult of the several supplies to build, due to the trouble encountered in locating parts. This supply should be capable of at least 10 amperes. The transformer that I employed is rated at 12 amperes with a full secondary voltage of 36. There is a drop of about 10 volts through the rectifiers, so if you want the full 28 VDC, you will have to have a transformer with a 38 volt secondary. Anything from 24 to 28 VDC is sufficient to run the transmitter. About the only difference that I observed between the two voltages was the speed at which the autotune system operated. The rectifiers are hooked up in a bridge circuit, using the entire secondary. The filter choke should have very low resistance. The filter capacitor should be rated at a minimum of 50 volts and have a capacitance of about 2000 μf.

The 450 volt supply is required to run the audio amplifier tubes, buffers, crystal calibrator tubes as well as the oscillator. It is imperative that this supply have good regulation. If not, the rig will chirp on CW. A filter capacitor of at least 100 μf should be used in this supply. A single 5U4 withstands the load very well. I have been using the same tube in my supply for over a year without a failure.

The 1500 volt supply employs a pair of 3B28 xenon rectifiers in a conventional full wave circuit. 866A tubes may be substituted but the 3B28 is much more reliable and will



Left: Inside view of converted ART-13. Above: panel view.



Power supply for high power ART-13.

require no "running in" if you move the tube. High regulation is not too important with this supply since the load is almost constant. It is used on phone only. About 8 μf should be sufficient to filter this supply.

The 2500 volt supply is a full wave voltage doubler circuit employing a total of ten 400 piv, 1 ampere silicon diodes. The transformer for this supply should have a secondary voltage of about 1000. This will result in a DC output of about 2500 or so. It should be filtered by at least 8 μf across the entire supply. The doublers should also be rated about 8 μf apiece at voltage of about 1500 since they are in series. Voltage transients might develop across these diodes; it would be good to connect a .001 μf capacitor across each of the rectifiers.

At this time, you might be wondering why I built two separate supplies for the two high voltages instead of getting both voltages from one. When I first went on the air with the rig, I had no intention of going high power. When I finally decided to, I didn't want to tear up what I had already put together so I just built the doubler on another chassis and wired it in with the main supply.

The modulation transformer is rated at a

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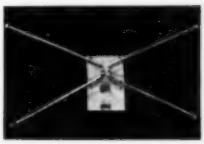

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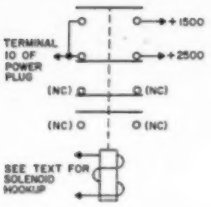

Transfer relay in unenergized position.

test voltage of 4000 and would probably withstand 2500, but the two 811s certainly will not. Therefore, it would not be advisable to run above 1500 volts when you are on phone. The average power input on phone is about 200 watts. Highest power will be obtainable on 80 meters, with slightly less on 40 and 20 meters.

I added a third meter in the dummy low frequency oscillator panel. This panel contains a 28 ohm filament resistor to act as a substitute for the 1625 used as the L. F. oscillator tube. If your ART-13 happens to have a L. F. oscillator unit instead of the panel, you may discard it, because it is of no use to the amateur. A dummy panel may be obtained from most of the places selling ART-13s. The additional meter has a range of 0-500 ma and is for measuring both plate and modulator current. A meter of less than 500 ma is not recommended because it might be damaged by the modulation peaks reached on phone. I broke the high voltage line at the modulation transformer to insert the meter, although it may be placed anywhere that is convenient and accessible to the operator. Disregard the P.A. Plate position of the multimeter, because it is not operative in that position. It is advisable to remove the porcelain bowl off the left side of the transmitter and replace it with another piece of aluminum so you can mount two coaxial fittings for transmitter and receiver antenna.

I added a new tank coil for use on the eighty meter band because of the high power. The variometer itself is sufficient for 40 and 20 meters. In order to mount this new coil it will be necessary to remove the low frequency antenna relay, K-105. It serves no purpose for the amateur in its present position, but it should be saved for use as a high voltage change-over relay for the 1500 and 2500 volts supplies. The new coil is the Air Dux Model PI #195-1 good for 500 watts. The original coil is left inside although it is not used for anything except support for the left end of the new coil. The right end is supported by two porcelain insulators which were fastened to the perforated side panel. The four-turn ten meter section, along with the plastic board, is removed before mounting.

When you first apply 28 volt to the rig and key it for a time or two, you will notice that the keying relay is rather loud. This noise discourages most hams from operating CW with this rig. It may be reduced or even cured by connecting a 50 volt electrolytic capacitor with a rating of somewhere between 50 and 100 μf from the test key switch to ground. This will reduce that loud clank to a weak click.

In its original condition, the transmitter employs an L-Net output circuit on 80 meters. This is not very good as far as harmonic suppression is concerned, so it was deemed best to convert it over to a Pi-Tank. In the October '63 issue of *QST*, there is an article on converting an ART-13 to SSB. The author also describes an output tank conversion in his text. I used that output tank conversion in my rig and found that it works very satisfactorily. Everything is still automatic so the autotune system remains intact and operative. I will not go into the details of the conversion here, but advise you to read this article, for the author gives a very accurate description of how to perform the operation.

On some of the transmitters a readjustment of the keying relay will be in order due to age and wear. The relay contacts are easily accessible from the top. However, if the relay is too slow for you on CW, you can speed it up a bit by loosening the spring in the bottom of the relay. The whole assembly must be removed for doing this. It is done by removing the connecting wires to the vacuum switch, taking off the Jones plug, and removing the screw in front of the modulation transformer. The relay may be keyed either with a straight key or an electronic keyer. A bug is not recommended, because the dits will have a somewhat ragged sound if one is used.

There may be some confusion as to what S_1 and S_2 are on the schematic. This is a switch that I mounted in the hole left vacant by the receiver terminal after it was removed. The new switch may be mounted in any position that is convenient to the operator. The purpose of this switch is to energize a 28 volt relay feeding primary voltage to the plate transformers. This relay should have very heavy contacts since it must withstand the full load surge on phone. The switch is wired in series with lead #3 of the power cable. I recommend breaking the line inside the transmitter rather than outside. Remove the side hood from the unit to reach the connector terminal. This switch will turn on the 450 volt supply. Both the 1500 and 2500 volt supplies have their

own separate switches farther on down the primary line so you can run the 450 alone with the others off.

As I mentioned earlier, the low frequency change-over relay (K-105) is removed. It may be used as a high voltage transfer relay for the 1500 and 2500 volt supplies. If this is desired, the transfer will be done automatically when you throw the mode switch from VOICE to CW. To accomplish this, run one side of the relay primary to a 28 volt source inside the transmitter (in my case, I tied it to the hot side of the switch that turns on the 28 volt relay delivering power to the plate transformers). The other side is to be connected to the second terminal from the bottom, on the left side, back wafer, or the mode switch. If most of your operation is CW, I might advise you to wire the two high voltages as shown in the diagram. However if most of your operation is on phone, reverse the two wires. But if you spend about equal amounts of time on both modes, either way is fine. The reason for this is so that the relay will not have to be on any more than is necessary.

To go back over a few miscellaneous items, it will be necessary for you to purchase a plug to fit the power receptacle on the transmitter. It is designated type U7/U and is available from Fair Radio in Lima, Ohio.

Due to the excessive plate voltage being used on CW, a small bit of idling current will be drawn by the 813 in the neighborhood of 10 or 20 ma. This will count against your tube dissipation capability, so it might be advisable to build a bias supply and connect it through a pot to the grid of the final. This has not been included on the schematic.

In regard to the efficiency of the transmitter, I have made several tests with an accurate wattmeter. With an input of 500 watts, it was putting out approximately 380 watts which is 75%. This measurement was made on 80 meters. Power output will be slightly less on 40 and 20 meters due to the lesser amount of drive available on these frequencies.

The VFO will really amaze you with its stability and calibrating accuracy. Even though it is over twenty years old, it outperforms many VFO units made commercially today.

The total cost of converting the ART-13 will vary with the individual's own supply of parts and what he has to buy. Therefore, I shall not try to make an estimate here. But when you get through, I guarantee that you will have a transmitter to be proud of and one that will give you many enjoyable hours of operating pleasure.

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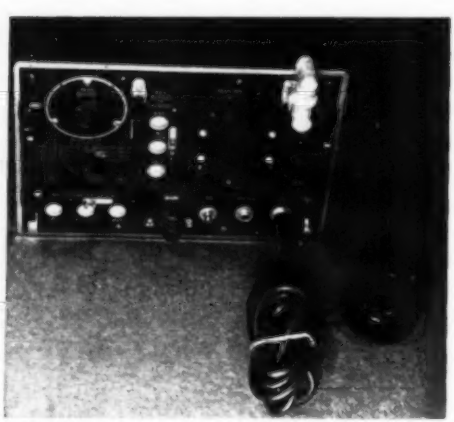
A Basic ac Conversion and Conversion-less Mobile Installation of the RT-19/ ARC-4 for 2 Meter Use

Roy Pafenberg W4WKA
316 Stratford Avenue
Fairfax, Virginia

Converting the ARC-4

The AN/ARC-4 aircraft radio set is once more available on the surplus market. It offers a cheap and convenient method of getting on 2 meters. The major component of the AN/ARC-4 is the receiver-transmitter RT-19/ARC-4 which provides four relay-selected, crystal controlled channels in the frequency range of 140 to 144 mc. No changes are required in the tuned circuits for 2 meter coverage. Power requirements for aircraft use were 12 or 24 volts depending on the dynamotor used. Power output of the AM transmitter is a nominal 8 watts into a 50 ohm load.

The widespread interest in fixed frequency, 2 meter mobile and home station net operation enhances the value of crystal controlled surplus equipment. Further, the swing to 12 volt automotive electrical systems means that much surplus equipment (such as the AN/ARC-4) which formerly required extensive modification now has immediate and practical amateur application. This article describes a conversion-less mobile application of the equipment and a simple, low cost basic ac conversion. Various refinements including internal speaker, rf and audio gain controls, channel selection system, squelch control, front panel transmitter crystal socket and receiver VFO were incorporated in the prototype and are presented separately to permit optional inclusion. The mobile application is presented last since it would require duplication of data that is essential to the understanding of the ac conversion.



Front panel of the converted receiver.

The photographs show construction details of the equipment. A 6V6 crystal oscillator drives two 6V6 and one 1616 (6L6) frequency multiplier stages which drive an 832 PA stage. A carbon microphone circuit feeds the push-pull 1614 modulator stage. The receiver section consists of two identical front ends which feed common *if* and audio stages. The two receiver sections, PLANE TO PLANE and PLANE TO GROUND, permit simultaneous monitoring of two frequencies. These sections consist of a 6AC7 mixer, no rf stage unfortunately, with two 6N7 tubes serving as crystal oscillator-multiplier stages to generate the HFO injection voltage. Three 12SJ7, 10 mc *if* stages follow, driving a diode detector, noise limiter and squelch circuit using two 12SQ7 tubes. Two 12A6 tubes, with a common grid circuit, provide two independent 500 ohm audio output channels.

The usual power requirement conversion problems exist in the AN/ARC-4. However, the availability of low cost, silicon diodes greatly simplifies the solution and makes the use of a 12 volt dc supply economically feasible and certainly far easier than rewiring of the circuits. Use of salvage TV power supply components reduces the power supply costs to the vanishing point. If you are lucky in your choice of a transformer, all the com-

ponents may be housed in the ex-dynamotor compartment. If not, the solution shown in the photographs may be used. The transformer is mounted on the back chassis wall and a clearance hole cut in the back of the case.

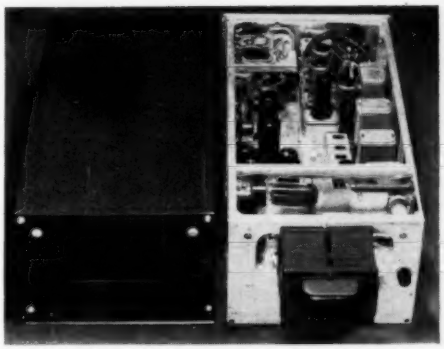
Loosen the two single-turn fasteners at the rear of the case and slide the chassis out. Remove and discard the two mounting angles at the bottom of the front panel, reinstalling the screws to fill the holes. Remove the dynamotor and take off the connector before discarding. Clean the connector up and install on the original plug.

The following steps remove the dc control relay, S6C and terminates the on-off switch, D1C, on the main power connector, PG1C, to permit use with the ac power supply. Remove the mounting hardware for the following components located at the rear of the chassis: relay S6C, resistor R4C and choke L2C. Unsolder the two white with yellow-yellow tracer wires from the inside chassis end of L2C. Unsolder the other end of one of the leads from Pin 2 of the dynamotor connector and discard. Dress the end of the other lead, which terminates on Pin 1 of the main chassis connector, to Pin 2 of the dynamotor connector and solder in place. Unsolder the white with brown-brown tracer lead from the junction of the S6C relay contact and resistor R4C. Unsolder the other end of this lead from Pin A1 of PG1C, leaving the second lead on this pin undisturbed. Unsolder and discard the white with blue-orange tracer lead running between the junction of the S6C relay coil and resistor R4C and Pin 8 of the main power connector. Unsolder the white with blue-orange tracer lead from the coil of relay S6C and solder this lead to Pin A1 of PG1C. Discard relay S6C, resistor R4C and choke L2C. These changes are shown in **Fig. 1A.**

All the required circuitry to accomplish the basic AC conversion and certain of the options is now available at the main power connector, PG1C, and the dynamotor connector, PG2C. Secure the matching female receptacle for plug PG1C, a Cannon DP-D32-33S, and mount in the center of the top of a Bud CU-2101, 3⅛" × 2⅛" × 1⅝" Minibox. The details are shown in the photographs. This box serves the dual function of a protective cover and as a convenient mounting for the switches required in certain of the options. Permanently strap Pins 3, 7, 9 and 10 on the back of the connector. This ties all +12 volt circuit points together and connects them to Pin 2 of the dynamotor connector. Permanently strap Pins 6, 15 and A2. This ties the filament return circuits to ground and connects them to Pin 1 of the dynamotor connector. Now strap Pin 19 to the same group. This completes the modulator cathode circuit which is disabled in certain aircraft interphone applications.

Strap Pins 16 and 17 which completes the B+ circuit and connects it to Pin 7 of the dynamotor connector. Connect an AC line cord, at least 16 gauge, to Pins 1 and A1. Strap Pins 2 and 20. This completes the AC circuit through switch D1C and supplies 115 volt AC to Pins 5 and 6 of the dynamotor connector. The following connections may be removed to install optional features and should be made so as to be readily removable. Strap Pins 18 and 28 which applies screen voltage to and thus activates the PLANE TO GROUND channel receiver. Strapping Pins 18 and 29 activates the PLANE TO PLANE channel and strapping all three pins provides reception on both channels. Ground Pin 14 which actuates the relay connecting the back crystal unit to both the transmitter and the PLANE TO GROUND receiver. Temporarily ground Pin 4. This grounds the B-return and provides a quick and dirty means of changing the fixed squelch bias and disabling the squelch circuit. This completes the preliminary work and the power supply may now be installed in the ex-dynamotor compartment.

As previously mentioned, this conversion draws heavily on salvage TV set power supply components. Choose a salvage TV transformer with a secondary capable of supplying a minimum of 300 volts DC at a minimum of 250 MA. In addition to a 5 volt at 3 ampere winding, two 6.3 volt windings rated at 5 amperes minimum are



Rear view of the converted receiver showing the transformer cutout.

required. The matching TV filter choke should also be secured. The units shown in the photograph are from an old Philco chassis and they run only warm in this application.

Arrange the components so that all fit with comfortable clearance and mount them in place. The photographs will serve as a guide but exact placement will depend on the specific components used. The silicon diodes specified provide a comfortable safety factor but a heat sink is still required. Mount the diodes, using insulating washers, to an aluminum bracket and secure the bracket to the chassis. Standoff posts may be used to mount the tube socket and high voltage filter capacitor. Note that the capacitor must be insulated from the chassis. Any screws through the chassis side panels must be countersunk so that the case be installed. The fuse post is mounted on the back of the chassis and a clearance hole punched in the back of the case. After all components are mounted, wire in accordance with Figure 2. After wiring is completed and checked, locate the microphone transformer T1T and connect a 1,000 μf, 15 WVDC tubular capacitor between Pin 2 and ground.

Carefully check your work and insure that a crystal unit is installed in the rear crystal socket. The crystals used in the AN/ARC-4 are Western Electric type 703A crystal units. The holder is a 3 pin device, mounting

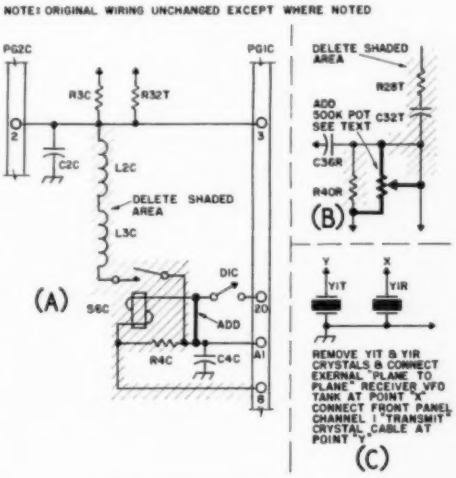


Fig. 1. Internal wiring changes.

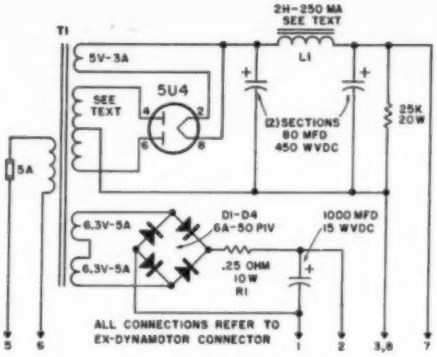


Fig. 2. Power supply.

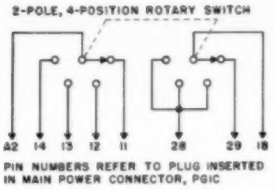


Fig. 3. Channel selector.

both the transmit and receive crystals. The blanks used are 11/16" square which is not too commonly used in surplus crystals. Since the design range of the equipment is 140 to 144 mc, there is little chance of getting surplus 703A units to fall in the 2 meter band. Those who desire may grind the crystals to the desired frequencies. While the technique is not difficult, it is beyond the scope of this article. The 3 pin sockets may be changed to the dual FT-243 type and these inexpensive surplus units used. In any event, the formulas are as follows:
Receiver:

$$\text{Receiver: } f = \frac{\text{F-10}}{16} \times 1{,}000$$

$$\text{Transmitter: } f = \frac{\text{F}}{24} \times 1{,}000$$

Where: f = Crystal Frequency in kcs
F = Carrier Frequency in mcs.

Therefore, for 144-148 mc coverage, the receiver crystals range between 8375.000 and 8625.000 kcs while the transmitter crystals range between 6000.000 and 6166.666 kcs.

Connect a 6 to 10 watt, 115 volt lamp to the antenna connector and plug a 0-1 made meter into the front panel metering jack. Turn the meter switch to the FILAMENT position and apply AC power. Turn the power switch on and the rear crystal relay should close while the meter deflects to about half scale. The tube filaments should also light. Throw the meter switch to the PLATE position and the meter should read around 0.6 ma. Now plug in a carbon microphone of the T-17 type. Turn the meter switch to the OSC IG position, depress the mike switch and the meter should read approximately quarter scale. Switch to 1ST HG IG adjusting L1T and L2T; switch to 2ND HG IG adjusting L3T and L4T; switch to 3RD HG IG adjusting L5T and, finally, switch to RF AMP IG, adjusting C6T and L8T. In each case, tune for maximum current and the meter readings should fall between quarter and half scale. Now switch to RF AMP IP and adjust L9T for minimum current while adjusting C1OT until the meter reads about half scale with L9T resonated. The lamp load should light brightly at this stage. Throw the meter switch to AUDIO AMP IP and whistle into the mike. The lamp load should glow brighter and the meter should swing upward from approximately half scale.

Now that the transmitter is out of the way, the receiver may be aligned. With a crystal installed, throw the meter switch to OSC IG and adjust L1R. As the slug is screwed in, the meter should climb to a peak and then abruptly drop to zero. The proper setting is approximately 80% of the maximum reading. Switch the meter to 2ND HG IG, adjusting L2R, and then to 3RD HG IG, adjusting L3R. Adjust for maximum meter reading which should be between 0.1 and 0.2 MA. Now connect a VTVM to the AGC line and adjust L4R for maximum negative voltage. Connect an antenna and adjust the front panel PLANE TO GROUND trimmers for maximum receiver noise. These trimmers must be peaked and signal generator or a reliable local signal is a big help.

This completes the basic, single crystal controlled frequency, AC conversion. The easiest to add refinement provides selection of any of four transmit and receive frequencies. Remove the main power connector-box assembly and take the cover off. In one end of the box, mount a small 4 position, 2 pole switch. Lift the temporary ground connection from Pin 14 and remove the jumper between Pins 18 and 28. Now wire the switch circuit as shown in **Fig. 3.** This provides reception of Channels 2, 3, and 4 on the PLANE TO GROUND receiver and reception of Channel 1 on the PLANE TO PLANE receiver. Switching of the receivers is automatically taken care of by the second section of the switch. Alignment of the PLANE TO PLANE receiver is identical to that of the PLANE TO GROUND receiver except that the meter switch is placed in the RF AMP IG position. A test lead is then patched from the P TO P HG IG test jack on the left side of the chassis to the 3 test jacks located on the top of the PLANE TO PLANE unit. Work from rear to front on these adjustments.

Squelch control is easy to add to the receiver. Simply install a SPST toggle switch on the end of the power connector box opposite the channel selector switch. Lift the temporary ground on Pin 4 of the connector and wire from A2 to 2. Closing the switch will now disable the squelch.

A dual RF and AF gain control may be installed in the THROTTLE SWITCH jack hole. Remove the jack and clip the single wire where it terminates on the microphone jack. Mount a dual, concentric shaft, 100,000 ohm linear taper and a 500,000 ohm audio taper control in the hole. Remove the mounting of the existing RF gain control, P1R and mount a 2 lug tie point at this location. Terminate the two series resistors, R24R and R64R, on this tie point. Remove the lead presently connected to Pin 4 of V4R and solder 18" leads to this pin and the 2 tie point lugs. Route the leads down the center of the chassis to the new control and wire to the 100,000 ohm section. The lead connected to R24R should go to the counterclockwise lug.

Connect a two conductor shielded cable to the 500,000 ohm section of the new control with the ground lead attached to the counterclockwise lug. Route the cable down the center of the chassis to the vicinity of the two 12A6 audio output tube sockets. Remove the white with green-green tracer lead which runs from Pin 5 of the front 12A6 to a 100,000 ohm resistor, R4OR, mounted on a terminal board just forward of the tube socket. Remove the resistor and ground the braid of the new cable to the same ground point. Connect the lead running to the "hot" contact of the control to the bottom lug from which the resistor was removed. Connect the lead running from the center arm of the control to Pin 5 of the front 12A6.

The modulator feeds audio into receiver audio amplifier to provide sidetone and this must be removed to avoid feedback if a speaker is used. Locate the white with green-green tracer lead which is connected to Pin 5 of the back 12A6 and enters the wiring harness. Clip this lead from Pin 5 and pull through the wiring harness to where it terminates on the back terminal board. Remove

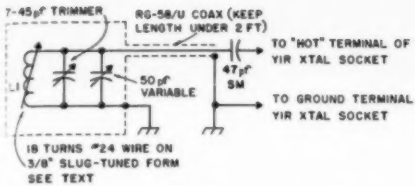

7-45pf TRIMMER
RG-58/U COAX (KEEP LENGTH UNDER 2 FT)
TO "HOT" TERMINAL OF YIR XTAL SOCKET
50pf VARIABLE
47pf SM
TO GROUND TERMINAL OF YIR XTAL SOCKET
L1
18 TURNS #24 WIRE ON 3/8" SLUG-TUNED FORM SEE TEXT

Fig. 4. Receiver VFO converter. Range is 8.3 to 8.7 mc.

this lead and the two series connected components on the terminal board. These parts, R28T and C32T, a 270,000 ohm resistor and a 5,000 pf capacitor are connected to pin 5 of the outside modulator tube socket. Remove and discard this lead. See **Fig. 1B** changes.

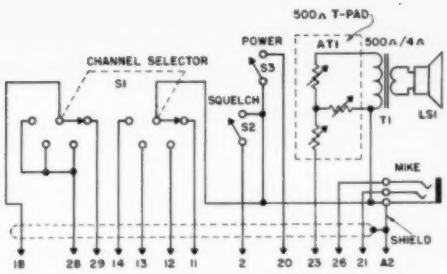
A 4" PM speaker and line matching transformer may be installed as shown in the photographs. The speaker is mounted over a 3" × 4" chassis cutout which in turn lines up with a set of ventilation holes in the case. The Merit A-3005 transformer matches the 500 ohm receiver output to the speaker voice coil. Mount the speaker and output transformer using countersunk flat head screws.

A front panel transmitter crystal socket may be installed with only minor circuit changes. However, this flexibility would not be of much value without a continuous tuning receiver. This is not difficult to accomplish. Since the PLANE TO PLANE receiver is used only on Channel 1, the Channel transmitter crystal socket is extended to the front panel and the PLANE TO PLANE receiver is converted to continuous tuning using an external tank circuit. Operation of the remaining channels is unchanged.

Carefully spot and drill holes for mounting an FT-243 type crystal socket immediately to the right of the meter. Mount the socket and, using a short length of RG-58/U cable, wire the new socket to the front transmitter crystal socket. A salvage FT-241 or FT-243 crystal holder may be used to terminate this cable. Before this change, active FT-243 crystals were required. With the added capacity of the cable, two capacitors must be changed to make the oscillator reliable. Locate the 50 pf capacitor, C2T, which is wired directly from Pin 5 to Pin 8 of the oscillator tube socket, V1T, and replace it with a 39 pf mica capacitor. Locate the 390 pf mica capacitor C3T, which is connected across the oscillator cathode inductor, L1T, and replace it with a 100 pf unit.

The PLANE TO PLANE receiver crystal oscillator becomes a tuned plate, tuned grid oscillator. A parallel tuned tank circuit which tunes the basic crystal range of 8375 to 8625 kc is connected to the existing crystal socket through a capacitor. No other circuit changes are required. While the tank circuit could be installed internally, there is little panel room for an adequate dial. The decision was therefore made to use an external tank circuit very much the same as the popular "tubeless" VFO's. Install a single hole mount BNC jack, an UG-625/U, immediately to the left of the meter and slightly below the top meter mounting hole. Connect a length of RG-58/U to the jack, grounding the shield. Extend this cable to the PLANE TO PLANE receiver crystal socket. Solder a 47 pf mica capacitor to the above ground terminal of this socket and connect the center conductor of the cable to this capacitor, grounding the braid at the ground terminal of the socket.

The external tank circuit may be mounted in any convenient cabinet and fitted with an available dial. However, the interconnecting cable must be kept short. The prototype which was installed after the photographs were taken was housed in a 3" × 4" × 5" utility box mounted to the left front side of the case. A short cable, fitted with BNC connectors, was used to join the two units. The schematic of this unit is shown in Figure 4. The coil used is a slug tuned, ⅜" diameter surplus unit with 18 turns of #24 wire. With the parts values shown and with the cable capacity of the unit described, the VFO tunes from 8300 to 8700 kc. Wire the unit as shown and connect to the receiver circuit. Now, by the usual plate



NOTE: ALL PIN NUMBERS REFER TO PLUG INSERTED IN MAIN POWER CONNECTOR, PGIC

Fig. 5. Remote control box for mobile use.

bending and slug adjustment, bring the unit to the desired frequency coverage. A grid dip meter is helpful in the first approximation and, after the unit is oscillating, a well calibrated receiver or frequency meter may be used for the final adjustment. Operation of the receiver is the same as for crystal control except that retrimming of the front panel adjustments will be required for any great frequency excursion.

As was mentioned, the AN/ARC-4 is ideal for fixed frequency, mobile net operation. When you purchase your set, get a mounting base thrown in (they are a drug on the market) and insure that the set has the type DY-10/ARC-4X dynamotor installed. This is a dual-voltage, 12 and 24 volt unit, while the more common DY-9/ARC-1 is usable only on 24 volts. A number of mounting bases are suitable. The MT-100/ARC-1, MT-101/ARC-4 and the MT-230/ARC will all accept the RT-19/ARC-4. The only material difference is that the AN/ARC-1 bases have the main connector reversed and that different output connectors are used. To avoid confusion, the installation described uses cables connected directly to the main connector of the mounting base.

The mobile installation described is for trunk mounting of the set in 12 volt, negative ground cars. A small control unit which includes a speaker, line matching transformer, audio level pad, squelch control, channel selector and power switch is mounted under the instrument panel. Fig. 5 shows the schematic diagram of this installation and lists the power connector strapping, the purpose of which has been described. Prior to installation, one internal wiring change is required on the dynamotor plug to permit remote squelch control. Strap Pins 5 and 8 which brings the B— point out to the main power connector.

Remove the wiring from the shock mount base, clean up the main chassis connector and discard the others. Install the mounting base in the trunk compartment and run in the antenna and primary power leads. Since the unit draws 14.5 amperes in the receive and 21 amperes in the transmit condition, use at least #4 wire and route directly from Pins A1 and A2 to the car battery. A 12 conductor cable plus ground is required to run between the mounting base and the control unit if all the described features are made available. Conductor size is not important and any available 12 conductor shielded cable may be used.

Operation is much the same as for the AC conversion. The PLANE TO PLANE receiver is used as the Channel 1 receiver while the PLANE TO GROUND receiver is used on the other channels. Crystal data is unchanged. Remote operation of a receiver VFO was not considered feasible and was not attempted. Set the RF gain control for best signal to noise on a moderately weak received signal and control output level with the audio pad.

While the performance of the AN/ARC-4 is not state of the art by any means, it provides a low cost answer to getting on 2 meters. Both the AC conversion and the mobile applications are fully feasible and are within the capabilities of even the inexperienced amateur.

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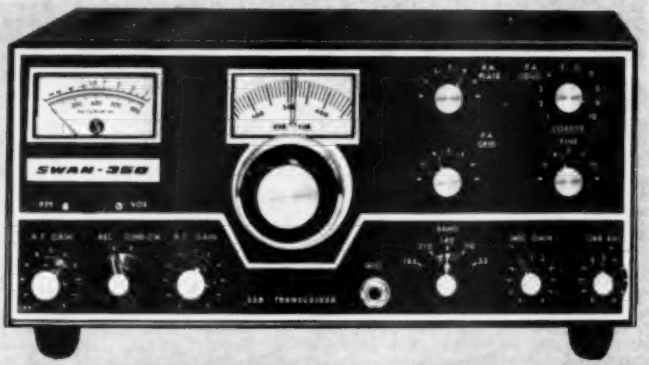

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The CV-253/ALR Converter

Recently there appeared on the surplus market a very interesting piece of equipment. It is called technically, "Electronic Frequency Converter CV-253/ALR." Actually it is a tunable converter covering the range from 38 mc to 1000 mc. This coverage entails most police and fire departments, the 6m, 2m, 1¼m and ¾ meter amateur bands, FM broadcast, TV, taxicabs, airlines, etc., etc., and who only knows what else up there.

The unit originally was used to replace the 4 tuning heads used in the old APR-1 or APR-4 radar search receivers. The -1 or -4 denotes the bandwidth of the 30mc *if* strip in the search receiver. The drawbacks to the old type tuning heads were legion: you changed heads to change the range; you had no rf stage ahead of the mixer (granted you have none in the two highest ranges of the new model, but the diode mixer compensates for this by lowering the noise figure of the new head considerably), with no rf stage you had no preselection. This resulted in receiving signals such as fc (receiving frequency), fc + fi (intermediate frequency), fc − fi, fc + 2fi, fc − 2fi, fc + 3fi, etc. With the tuned rf stage in sections A and B we get the preselection necessary to reject such suprious signals. In sections C and D, you have two cavity-tuned preselectors. The two cascaded cavities have a Q in the high thousands region, thus assuring a very good rejection of wanted signals.

I picked up one of these units, complete in sealed box (overseas crate, similar to cast iron coffin), as a lark, just to see what Uncle Sam calls an electronic frequency converter. When I passed through the packaging barrier and reached the lower level of packing, I began to realize the golden egg was here. When finally unwrapped, I undid a few screws, removed the covers and gazed upon the nicest looking packaging job I've seen in quite a while. One word of warning, when loosening the screws, unscrew only 1½ turns on each with exception of the two on the side covers near the front. The genius who designed this did away with nuts and bolts as such. The screws are anchored by a threaded plate and the covers are slotted to facilitate easy removal in a matter of seconds. Just think, there are only four screws that can be lost. What's the surplus world coming to?

Inside the unit can be found all the pertinent data needed for alignment and testing. It is printed on the inside of the two covers and on all subchassis inside the unit. No more can you scurry around trying to find the extinct instruction book, or twiddle screws trying to

find out which does what, or spend fruitless hours tracing out a circuit which uses all the same colored wire. No more do you have to take apart the entire unit to find out where the power goes, or get electrocuted while applying power to the unit when it's spread out all over the table. I feel I am witnessing the passing of a nostalgic era.

The two covers are marked as to their function, and what is printed underneath. Removing the cover which has the schematic printed on it, I found all I needed to put the unit into operation. Checking out the unit I discovered several interesting points.

Although all filaments run continuously, the converter has the disadvantage of having the oscillator plate voltage switched when changing bands. This causes a drift problem, which we will settle later in this article. The unit requires +300 VDC for rf, oscillator and mixer plates (purists need not cringe at this voltage on the mixer, as a dropping resistor inside the unit lowers the mixer voltage to a decent potential), 6.3 vac at 1.6 a. If you decide to use the search potential you'll need 28 vdc. It's a device which would be nice for band scanning to check for band openings by watching the MUF. A buit-in feature is that you can set limits for scanning, and the unit is self-reversing when reaching the end of the scanning area.

The most drastic change needed is to build a stiffly regulated power supply at 300 v at 100 ma to run the unit. Any handbook will help here. Then go inside the unit and tie together all B+ leads to a common point. This allows all 4 bands to run continuously. These points may be found under the righthand cover (with unit facing you). There is a terminal junction strip, midway between band C and band D sections. It has six shielded terminations and four single lead white terminations. These four white terminations are the B+ check points of the unit. Jumpering these four together puts B+ on all four sections simultaneously.

A good idea is one the military uses; it costs money when the electricity bill comes in, but in some cases it might be worth it. They let their receivers run continuously, 24 hours a day, 7 days a week, even when not being used. This results in higher stability, longer tube life, and avoidance of long waits for the oscillator to quiet down.

The sensitivity of these units is quite remarkable. In measurement of sensitivity the better the equipment used, the more accurate are your figures. Lacking the fancy stuff, I had to rely on the data sheet found inside the box along with the tuning head. Since the unit was unused, I feel quite certain these figures are accurate. The numbers are quite low, *i.e.*, and 0.9 μv at 38 mc, 3.3 μv at 2m and 220 mc, and 9 μv at 430 mc. Of course it's nothing like a good crystal-controlled low-noise front end converter, but for the quickest and cheapest way to get on all amateur VHF bands (up to 432) it can't be beat. The bandwidth of the unit makes it an excellent device for wide-band FM work, and ATV work.

Connections to the rear can be made by banana plugs to hook up the plate voltage, filaments and search motor voltage. The *if* output is another problem. The connector is of the GR 50 ohm type, and unless you have access to adapters, it is wise to change it. Removal of the connector is quite simple and it is easily replaced with a type N connection. Don't squint at using such a fancy connection at 30 mc. I belong to the school that doesn't like 225 ohm bumps in my coax line, as you get from a type UHF connection. If you read fine print, you find that the only true 50 connections available readily to hams are the BNC type, used on RG-58/U, 62/U, 59/U, etc., type coax, and the type N unit used with RG-8U, 9/U, etc., type coax. The type N, by the way, will handle 1 kw cool and sweet up the 500 mc.

The antenna connections are made on the front, with separate connectors for each band. This eliminates switching antennas with band change.

You're all set, get up some antennas and join the fun on UHF, or if you get tired you can always listen to TV (minus the boob tube) or drop in on fire or police calls. You'll find it fun, no matter which you choose.

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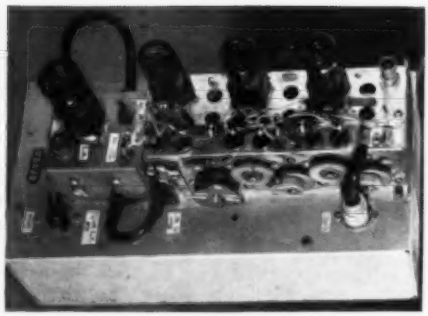


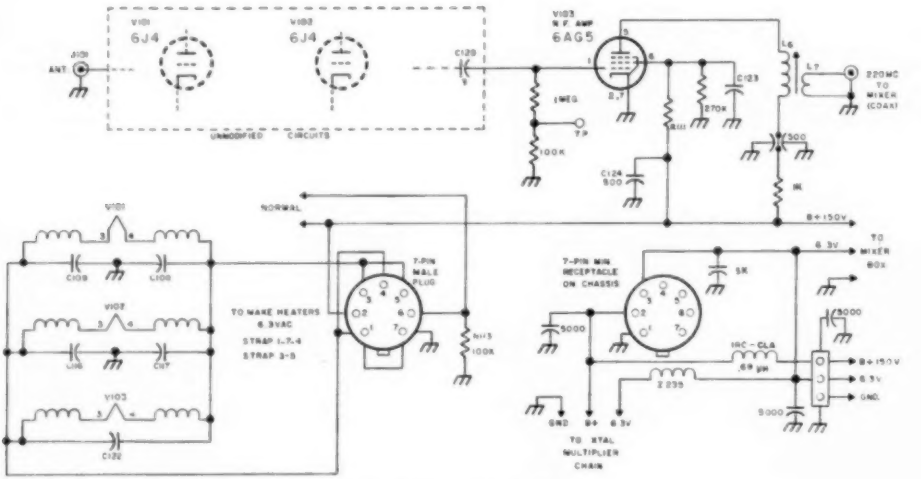
Mixer and modified rf amplifier.

220 mc Converter from the ARC-27

A very nice 220 mc converter may be constructed around the RT-178/ARC-27 main receiver RF amplifier subassembly. This particular unit, which is a small module containing three tubes, is used in the ARC-27 as the front end of the main receiver which tuned the usual military range of 225 to 399.9 mc. Since it will actually tune the 220-225 mc amateur band as well without any modifications to its tuned circuits, the results are good for ham use.

This article will describe how the sub-assembly may be mated with a crystal-multiplier chain and mixer to form a completed 220 mc converter. One of the main advantages of such a converter as this is the rf selectivity afforded by three sharply tuned, high "Q" 220 mc tank circuits. This is in sharp contrast to the usual broad-band crystal controlled converters, that are so commonly used these days.

On 220 mc in many localities considerable



Modified ARC rf assembly.

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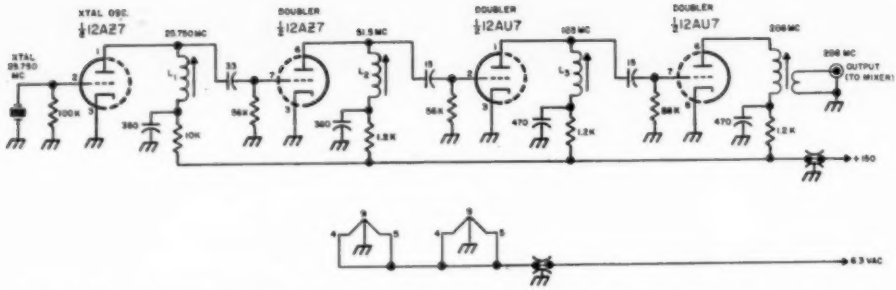


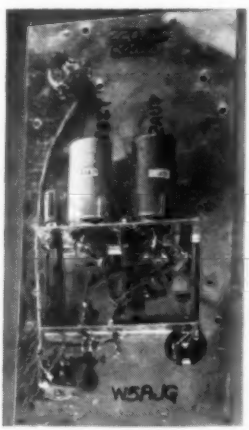
Crystal oscillator and multiplier string. L1 is 26 T, L2 is 12 T, and L3 is 5 T. All are on ¼ in. forms with iron cores. L4 (206 mc) is 3 T on ⅜ in. ceramic form with iron slug. The output link is 2 turns on cold end.

trouble has been experienced with various TV-FM spurious or birdie signals due to undesired mixing, overload, leak-thru, etc, from these powerful signals. By using some sharply tuned rf ahead of the mixer tube at 220 mc, an unusually clean response is obtained overall. Bear in mind, however, that when excursions across the band exceeds more than a couple of hundred kilocycles, it will be necessary to touch up the rf tuning a bit. This is actually a small price to pay for the results obtained and it is actually fun to be able to peak up on each individual received.

As for a source of supply—these units are to be found in surplus and more especially in local junk-yards. One must know the appearance of the unit and just what to look for. The ARC-27 set is beginning to show up in increasing supply and various parts and pieces of the unit are also showing up along with the more or less complete hulls. Often, these sub-assemblies are new in original packing, having been stocked for spare parts, and are real desirable pieces of UHF gear.

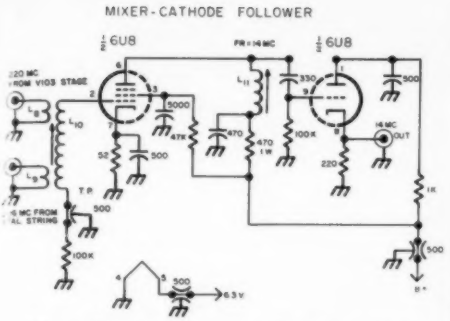
The Collins part number appearing on the main rf amplifier unit is 505-4390-005, if that is of any help. A reference to the photograph of the topside of the completed 220 mc converter will illustrate its appearance. Be on the lookout for one next you scrounge your junk-yard. To describe this unit a bit—we should start by saying that two stages (V101, V102) of rf preamplification using type 6J4 triodes are used in a grounded grid configuration. As in most all other sub-assemblies of the ARC-27, the tuners are of the "Hubbard" variety. They are all ganged by means of a series of meshing gears and all three tank circuits contained may be tuned very easily as one peaks across the band. The third tube (V103) is a type 6AG5 mixer stage. This stage as is, could not be made to work very well, since the original purpose was a bit different from our requirements. Therefore, it was made into a 3rd rf amplifier stage, and an additional mixer tube was built up in a separate minibox and mounted adjacent to the rf stages. This 6AG5 stage (V103) is the only portion of the procured assembly that needs a bit of changing—and this change consists of adding a plate coil resonant to 220 mc and a coax couplint link to be fed into the new mixer box.

For an oscillator-multiplier chain, another shielded enclosure is used, containing two tubes, one type 12AZ7 and one type 12AU7. This box is mounted underneath the chassis plate and is bottled up tight, with its injection output being fed to the mixer box only via a short coax cable. Since an *if* of 14 mc is used for all converters here at W5AJG, the crystal chain starts with a frequency of 25.750 mc. The progression is then $2 \times 2 \times 2$, in the remaining three triode sections of the two tubes. It was found that the old-fashioned doubling method was more stable, reliable and produced more output than starting with a



Bottom view of converter showing oscillator - multipliers and power connectors.

Photos by Jim Dungan



Mixer. L8 and L9 are 2 T links. L10 is 3 T #18 tinned on ⅜ in. ceramic form with iron slug. L11 is 30 T #28 enamelled wire on ⅜ in. iron cored slug.

ery high frequency crystal and fewer stages. Link coupling from the injection string to the mixer and ample tuned circuits, along with power lead filtering, results in no spurious unwanted beats. Should an *if* other than 14 mc be desired, the string may be altered to suit the desired frequency.

Modification And Construction

The converter is assembled on a fairly heavy thickness aluminum plate 5 × 10 inches in size, to fit a stock BUD chassis box of 10 × 5 × 3 inches. Copper or brass may be used for the plate if desired, but it is not necessary since the converter will consist of three separate mounted boxes—the converted ARC-27 portion, the new mixer box and the new oscillator string compartment box.

Not too much work is involved in modifying the unit. (Fig. 1) First, the filaments or heaters should be changed over to 6.3V ac operation instead of the original 24V dc hookup. This is quite simply done by a couple of wire straps. Terminals (3 to 5) as well as (4 to 1) should be connected together and 6.3V ac fed into terminal 3.

Next the avc line on V101 and V102 should be grounded by strapping terminal 7 to terminal 1, with terminal 6 being unused. Of course, if avc is actually desired on the converter, then terminal 7 could be connected into the companion receiver avc bus. At this particular location, avc on the converter was not needed or desired.

Next change V-103 into the 3rd rf amplifier. It might seem that the pentode 6AG5 is a poor choice for an rf amplifier, but since the NF has been set by the two previous 6J4's, its use will be satisfactory here. By referring to the modified schematic once again, it is apparent that L6 and L7 have been added. L6 is resonated at 220 mc with the

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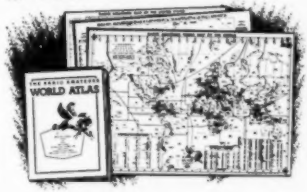
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aid of a GDO and L7 is a two turn link to be used to couple by coax cable the output of the preamplifier to the new mixer box. Test point T-P may be used to be sure the previous rf stages are peaked on the nose. This should complete the pre-amplifier unit.

Now for the new mixer tube (Fig. 2). This is a type 6U8 and is employed as a mixer-cathode follower with output at the *if* frequency of 14 mc. This box enclosure is of the mini-box variety and can be a standard 1.75 2×2 inch size. Again referring to the top-side photo, it can be seen that on the left is the coax cable carrying the crystal string injection—and on the right is the input carrying the 220 mc preselection, also in a coax cable, as well as the output connector for the 14 mc. *if*.

Input coil L10 is GDO'ed to 220 mc and the two input links wrapped around the cold end of same. The remainder of the mixer-follower circuit is perfectly vanilla and should present nothing tricky in character. The test point labelled (T-P) is very convenient to measure for the proper amount of injection being produced by the crystal string. More on this item later, when we tune up.

This leaves the oscillator-multiplier section in the shielded compartment underneath the chassis plate which contains the two double triode tubes (Fig. 3). The crystal oscillator is a 25.750 mc unit, and the second half of the first triode (12AZ7) doubles to 51.5 mc. From this point, it drives into the second triode (12AU7) which doubles to 103 mc and thence into the last triode section to double again to 206 mc. This output is transferred via coax cable to the mixer box top-side of the chassis plate. The coupling links are adjusted so that the proper injection voltage reaches the grid of the mixer tube as mentioned above. Ordinary iron slug coil are used, some phenolic and some ceramic as indicated. The complete converter power supply requirements are: 150 V dc at 50 ma and 6.3v ac at 2.5A.

Operation And Tune Up

The crystal oscillator string should be checked with a GDO or absorption meter to see that all tanks are resonating at the proper frequencies. Apply power and check for proper voltages on the plates of the 6J4's. They should measure about 100 volts. Using a signal generator coupled to input receptacle J-101 and set at a frequency of 220 mc—adjust the gears on the ARC-27 unit for maximum signal. Trimmers Z101A, Z102A and Z103A associated with the Hubbard tanks can be peaked at this time. The 6AG5 plate slug and the mixer input slug are next adjusted for maximum signal. At this stage, the test point (T-P) on the mixer grid is checked with a VTVM. Voltage as measured at this point should run between −2.0 and −4.5 volts. If it is low, repeak the oscillator-multiplier string coil slugs and the adjustment of the coupling loops, L5, L8 and L9 for maximum transfer of energy. Ample injection voltage should be available without sweat.

When the signal has been maximized with all trimmers and slugs, the generator can be replaced with the antenna. At this point, a goodly amount of ignition noise should be heard (unless you live on cloud 9) and this will be a good sign. From here on, the best way to tweak up all the controls is with an on the air weak 220 mc signal from out of town. It just can't be beat. Do not peak up on a strong signal—null the antenna if necessary until the signal is just above the noise, and then readjust all controls. Means for measuring the absolute noise-figure are not available at this station, so no claims can be made. The 6J4 triode has a pretty good figure of merit and a transconductance of 12,000 micromhos, which makes it a good performer at 220 mc, and the converter should certainly be sensitive to somewhat less than one-half microvolt for a signal report of Q5. Again, means are not available here to go very much below this level of sensitivity without generator feed-through. No spurious signals were present on the 220-225 mc band when using the converter working into the station 75A4 receiver.

It has probably occured to ask if this ARC-27 rf unit would work on 432 mc since the top range is known to be 399.9 mc. Yes—by removing or bending back some of the rotor segments of the Hubbard tanks, the GDO will indicate resonance at 432 mc. This was actually done on a second unit and an attempt was made to use the assembly as a 432 mc preamplifier ahead of the 432 mc receiver in station use. Results were rather disappointing however, mainly due, it is thought, to the problem of coupling out of the unit into a low impedance coax line. V103 was not used in this instance, as the pentode 6AG5 is not suited to this frequency. It would be necessary to change out this tube type with something better. This would all turn out to be somewhat of a major construction task, and it is for for this reason that it is felt that the main worthiness of the unit is for operation on 220 mc and not it's potential 432 mc usage.

Thanks to fellow amateur AF5QOA for his help in completing this project. . . . W5AJG

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	300-C	50-54	14-18	$12.95 ppd.
	300-J	50-52	28-30	$12.95 ppd.
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	300-N5	122-123	.6-1.6	$13.95 ppd.
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Need a GDO good to 500 mc? Here's an easy conversion for the UHF men.

Adding GDO Features to the TS-47A/APR

Photo credit: Jim Dungan

Leroy May W5AJG
9428 Hobart St.
Dallas 18, Texas

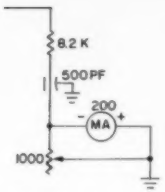
The surplus Test Oscillator TS-47A/APR is a compact self-contained calibrated oscillator originally designed by the General Radio Company during WW II. It was first described in the G. R. Experimenter in November 1946 and provides a calibrated VHF-UHF signal source.

The frequency range is from 40 mc to 500 mc, fundamental in two bands—40 to 115 mc and 115 to 500 mc. The oscillator tube is a type 9002 and is used in a semi-butterfly tank circuit configuration.

The output signal may be straight CW, or modulated at 50% @ 1,000 cps sine-wave, or a pulsed 500 cps with a 70 micro-second pulse width. Power input is either 115 or 230 volts ac, 50 to 2600 cps, and the weight is about 15 pounds.

This is an excellent instrument for the VHF-UHF man, since it covers 50, 220 and 432 mc with fundamental type signals. It was originally used for the testing of radar search receivers of the APR-1, APR-4, APR-5 and RDO class. The feature of the blocking oscillator for pulse modulation is a very fine way for checking VHF-UHF converter performance, covering the above bands. This type of alignment was covered in an article appearing in QST for March 1961. It is recommended reading. Although the reference article recommends a crystal controlled signal generator, nevertheless, the TS-47A works quite well in the pulsed position. The cost of the instrument will usually run around the same price, or perhaps a bit less, than the price of a BC-221 unit. It is not to be confused, however, with a frequency meter—being primarily an oscillator or signal generator.

After using the instrument for several years, fellow ham W5QOA, suggested the possibility of converting the unit for grid-dip oscillator service, thereby adding another useful capability to an already excellent instrument. In this manner, it would be possible to "look into" various circuits, such as coax cavities or any other configuration which terminated into, or out of, a coax receptacle. For instance, it would be possible to connect a coax



Addition of meter.

jumper cable from the TS-47 to the antenna output receptacle of the final amplifier cavity and check the resonant frequency of the cavity. In other words, anything more or less closed up and difficult to reach with the normal type GDO procedure may be checked in a number of instances with this modified signal-generator.

Additionally, other normal GDO functions, such as neutralization, feed-thru, various forms of antenna checking, etc., may also be performed, since this modification contains the usual means to disable the B plus to the oscillator and thus convert the instrument to indicate rectified rf.

Since the necessary alterations are rather simple in nature, it is felt they are well worth the time, small trouble and small expense involved to make the changes.

Modifications

1. Remove the power plug on the front panel of the instrument and install a one inch surplus or otherwise 200 micro-amp mill meter. The meter is to be mounted over the hole left by the plug removal by utilizing a "U" shaped bracket, false panel plate drilled to accept the meter, or by any other expedient means to accomplish the job. The particular meter as used here was a one-inch round International Instrument 100 micro-amp dc, which required a one-inch mounting hole. Stock No. 3-12 and sold for $4.75 from Fay-Bill Distributing Company, 79 White Street, New York 13, New York.

2. Drill a hole in the lower left area of the panel (see photo) for the 110v ac power cord. Connect this power cord to the two wires just removed from the original power plug (the two that formally carried the ac line voltage).

3. Drill a small hole in the aluminum chassis casting of the oscillator housing, about one inch below capacitor C107, to mount a 500 mmfd feed through capacitor. Remove the ground end of the 8.2k grid leak resistor from ground and connect to the inner compartment side of the new feed-thru capacitor. Connect the other side of the feed-thru capacitor to the negative terminal of the 200 micro-amp meter. The positive side of the meter is now grounded. So that the desired adjustment of the meter may be accomplished, install a variable pot of 1K across the meter to act as a sensitivity control. This control is to be mounted in an unused area on the lower left of the front panel. Refer to the photo again for exact placement.

4. Normally the pilot light is controlled by a switch so as to be able to extinguish it if need be. Reconnect he pilot light to 6.3v in a permanent fashion and then use this switch to disable the B+ voltage feeding the oscillator tube, thereby providing the rf rectification feature previously mentioned.

5. Make up a one-turn coupling loop on the end of a piece of coax cable to enable the meter to be coupled to open type circuits, such as exposed coils, lines, etc.

6. Use an ordinary coax cable with plugs on either end to couple the TS-47 to closed type circuits, such as cavities and other circuits that terminate in or out via coax receptacles.

Usable harmonics up to 3,000 mc may be used with the TS-47A. On its normal fundamental ranges, the output is adjustable to approximately 3 mw maximum and the output impedance is 50 ohms to a type "N" receptacle. This unit does have provisions for battery operation if it is deemed necessary. The use of the TS-47A as a signal generator for measurement of the sensitivity of a receiver in absolute values is not possible, as the shielding of the unit is not sufficient to completely bottle up the output, nor is the method of output control adequate for this type work. However, it is a very useful piece of test gear for many other purposes in the VHF-UHF frequency ranges.

. . . W5AJG

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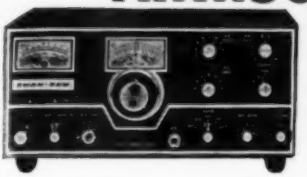

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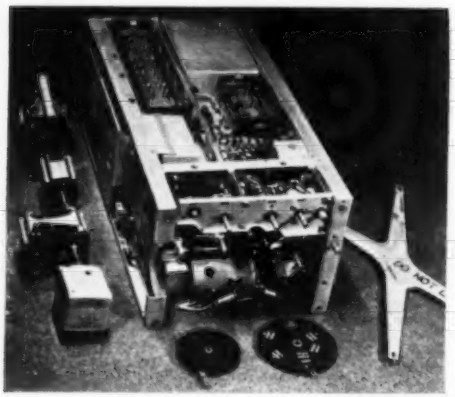


Conversion of the AN/ARR-15 provides a modern PTO receiver in the classic Collins design

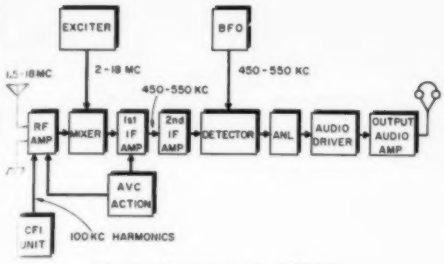
A Surplus Gold Mine

Roy E. Pafenberg W4WKM
709 North Oakland Street
Arlington, Virginia

Possibly the best buy on today's surplus market is the Collin's R-105A/ARR-15 or 51H3 high frequency aircraft receiver. It is a modern, 14 tube, single conversion superheterodyne receiver with one rf stage and two *if* stages. Frequency coverage is 1.5 to 18.5 mc in six bands. The receiver operates with a dynamotor from the usual 28 volt aircraft supply. The unit measures 7⅞" x 10⅜" x 21 9/16" and weighs 39 pounds.

The receiver, except for the loudspeaker, is completely self contained and all of the required operating controls appear on the front panel. The equipment may be operated from a remote position and a 10 channel autotune system is incorporated for this purpose. Ten frequencies may be manually selected and the autotune controls locked. These frequencies may then be selected by the motor driven system by operating the selector switch on the front panel or at a

Top: Before
Middle: During
Bottom: After

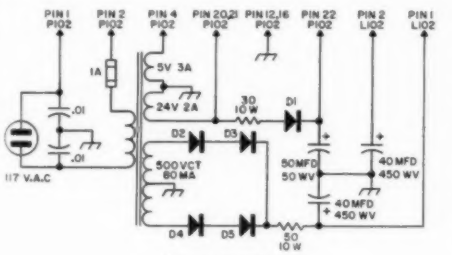


Block diagram of ARR15.

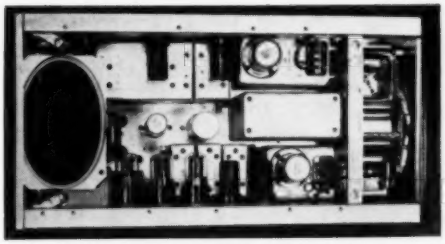
remote position. The autotune system is removed in this conversion since I had no use for this feature. Also, it was desired to reduce the loading on the manual tuning controls and the space gained by its removal makes the conversion easier.

Major features include the use of two Collins PTO units in the BFO and in the conversion oscillator spots. The front end 70E-2 PTO is ganged to the usual Collins slug rack which tunes the front end stages. The 70E-2 BFO PTO is ganged to a second slug rack which tunes the *if* stages across a 100 kc band. The nominal *if* frequency is 500 kc, adjustable ±50 kc. This feature was used in the original circuit to generate a calibration signal that, in conjunction with the 100 kc CFI unit, enabled the front end circuits to be set precisely to the desired operating frequency. The calibration circuitry is quite elaborate and produces frequency meter accuracy. Fig. 1 shows the system better than words. It is obvious that this feature could be used as a variable frequency *if* system and provision is made for this in the conversion.

The heart of the receiver is the front end PTO which covers a range of 2.0 to 3.0 mc in ten linearly calibrated revolutions. This unit drives a frequency multiplier stage, the output of which is used in the mixer. The PTO is geared to the slug rack which tunes the frequency multiplier, the rf amplifier and the mixer grid circuits. Frequency relationships existing for the various bands are as follows:



Power supply.



Details of speaker mounting, pilot light support and the stripped down autotune heads are shown here.

Band	Frequency Range (mc)	HF Osc Freq (mc)	Injection Freq (mc)	Received Frequency Compared to Injection Frequency (mc)
A	1.5- 2.5	2-3	2- 3	−0.5
B	2.5- 3.5	2-3	2- 3	+0.5
C	3.5- 5.5	2-3	4- 6	−0.5
D	5.5- 8.5	2-3	6- 9	−0.5
E	8.5-12.5	2-3	8-12	+0.5
F	12.5-18.5	2-3	12-18	+0.5

The conversion of the receiver can be as simple or as elaborate as is desired. The basic conversion involves removal of the dynamotor and substitution of ac plate, 24 volt ac filament and 24 volt dc supplies. The autotune system is completely removed and suitable tuning controls extended to the front panel. Certain switching functions which were accomplished by the one CW-AM control have been broken out on separate switches for greater flexibility. The same is true of the audio and rf gain controls.

Some of the considerations which brought about the conversion in its present form may not be apparent at first glance and a brief discussion of the more salient points is probably in order. The calibration or CFI unit is controlled by a relay which removes and grounds the antenna, applies power to the unit and connects the output to the receiver input. The relay is controlled by a microswitch which is actuated when the BFO is tuned away from the 500 kc detent. I removed this switch and installed a toggle switch.

The gain control consists of a T-pad in the audio output circuit which is ganged to the usual rf gain control in the cathodes of the

rf and *if* stages. A separate rf gain control is installed and an audio control installed at the input of the audio amplifier. Delayed AGC is used in both the AM and CW modes, although partial control of AGC action is obtained by switching in additional delay voltage in the CW mode position. This feature is not disturbed since its deactivation is not worth the effort. Instead, an AGC ON-OFF switch is added which grounds the AGC line in the OFF position. A very effective noise limiter circuit is provided. Original plans called for a defeat switch to reduce audio distortion when the limiter was not required. However, the limiter is self adjusting and the clipping level rides above the level of the received signal. No appreciable distortion is introduced by leaving it in the circuit.

A low pass-band pass filter is included between the audio driver and output stages. A relay is mounted in the filter can and the original mode switch is wired to switch the filter to the band pass condition in the CW position. This feature is retained and a audio filter IN-OUT switch is installed to permit independent control of the filter. The audio gain is a bit low, since the receiver is designed to drive low impedance headsets. Use of a 1 megohm gain control in the first audio stage grid instead of the 470,000 ohm resister used in the original circuit picks up some gain. 20 uf cathode bypass capacitors in both the driver and the output stage provide all the gain increase that is required. The existing 7,000 to 300 ohm audio output transformer is retained and wired to a new, normal through, front panel phone jack. A 4" x 6" PM loudspeaker is in the rear of the former dynamotor well and a line matching transformer is installed on the speaker frame.

The first step in the conversion is to remove the dynamotor and its filter box and to reinstall such of the hardware as will be required in the finished conversion. Loosen the single turn fastener at the rear of the case and remove from the chassis. Remove the screws that secure the "X" member to the top of the chassis and discard the stamping along with the hardware. Loosen the dynamotor retaining clips, unplug and discard the unit. Unplug J 109 from P 102 which is mounted on the side of the dynamotor filter box. Clip the lead connected to terminal at 1 of L 102 at the point where it terminates at the end of the filter box. Remove the screws which hold the box in place and remove the box. Remove the cover to the box and strip out all components. Saw a rectangle from the side of the box which mounted P 102 and dress the edges smooth. Clean up P 102, placing it in its original orientation, inside the chassis. Place the plate on the outside of the chassis, over the cutout, and install the original mounting screws, through the plate and chassis cutout and into the tapped holes in the body of P 102. From the other side of the filter box, cut an "L" shaped bracket to just fit in the open space at the end of the chassis which was occupied by the old P 101. Mount this bracket in place with a couple of screws, approximately ½" in from the end of the chassis. Mount a male AC receptacle and a fuse post on this bracket, making sure that clearance is maintained for the walls of the connector cutout in the back of the case. The work is easier than it sounds and the photographs explain it better than words. Discard the remains of the filter box and all the components which were mounted in it.

The front end of the receiver next receives attention. Stand the unit face up, remove and discard the front panel handles. Remove the clip which secures the coaxial cable to the antenna post and pull the cable free. Remove the dial light switch retaining nut, all the knobs and dust-proofing hardware, the Autotune locking screws and the antenna connector assembly, discarding the works. Remove and retain the front panel. Position the BFO dial at the "O" or detent position, set the band change switch to the center of a band position and set the frequency dial exactly to a dial division. Using masking tape, fasten the scales together so that their relative position will not be changed. Remove and save the retaining rings on each dial shaft and the hardware which holds the dial pointers. Very carefully remove the dial assemblies and set them aside. Carefully mark the position of the gears at the rear of the Autotune units and DO NOT CHANGE THE POSITIONS OF THE GEARS WHICH DRIVE THE INTERNAL TUNING ELEMENTS OF THE SET!

Remove the cover of the Autotune assembly, O 147; remove the screws which secure it to the casting and discard the entire unit. Remove the screws that secure J 111 to the casting, clip all leads connected to it and discard the receptacle. Remove the cover of relay K 102 and the screws which secure it to the casting. Clip the attached leads and discard the unit. Clip the leads attached to the calibrate control switch, S 103, remove the "C" washer that secures its actuating lever and remove the switch mounting hardware. Discard the complete assembly. Unplug receptacle, J 110 from the plug, P 103. Clip all leads attached to the plug which is mounted on the Autotune casting. Remove the plug and, after carefully cleaning it up, reinstall and attach J 110.

Remove the cover on the CFI unit to give access to the Autotune motor mounting screws. Remove these screws and reinstall the CFI unit cover. Clip the leads attached to the motor, pilot light switch and pilot light assembly, discarding everything except the lamps and mounting bracket. Remove the sub-panel which mounts J 111, R 139, R 144, S 104 and S 105. Clip all leads attached to these components and discard the complete assembly. Remove the standoff posts which mounted the subpanel, retaining one of them to remount the pilot light bracket. The wiring harness which wired all components in front of the Autotune casting is now free and may be removed and discarded.

Remove the three screws which mount each of the two Autotune heads, remove the units and set them aside. Carefully saw off the line shaft and line shaft gear drive mounting brackets flush with the other protrusions from the Autotune casting. Remove and discard the complete line drive assembly. Dress down the saw cuts with a file and very carefully remove the filings.

The Autotune heads are next on the agenda. The objective is to retain the dial mounting hardware as a support for the dials and the through shafts which couple the front panel knobs to the internal mechanism of the set. On the other hand, such portions of the assembles that can be removed should be to reduce friction in the manual drive. First to be removed should be the vernier drive shaft on the rf tuning head. This vernier drive has too much backlash to be of any value. The next step is to remove and discard the sheet metal covers of the units. From this point, you are on your own. This entire issue of 73 Magazine would be required to describe in detail the intricacies of these devices. Keep the objectives in mind and start stripping. The photographs show about how far you can go. To say the least, you will end up with a marvelous collection of strangely shaped, stainless steel hardware. When the stripped down units pass inspection, remount them in their original position. Reinstall the dials and the associated hardware. Rotate the dials through their range and insure that gear alignment, dial readings and slug rack positions are all as before the units were removed.

Attach a 300 ohm to 3 ohm line matching transformer

to the speaker and temporarily mount the unit to the rear chassis lip as shown in the photographs. Next, arrange the various power supply components, as shown in the photo, on the deck of the dynamotor well. Filter capacitor, C 144 is removed and mounting hole may be enlarged for a twist-tab electrolytic capacitor. In the parts layout, make certain there is no conflict with the speaker frame or output transformer. The Fair #818 power transformer is highly recommended. Aside from furnishing the required voltages, its compact construction and ease of mounting make it ideal. It is one of a line of power transformers specifically designed for surplus conversions and is available from Fair Radio Sales Company, 2133 Elida Road, P.O. Box 1105, Lima, Ohio.

Drill and cut a new face panel using the old panel as a guide. Temporarily assemble the "sandwich" of the old and new panels. Remove the screws which mount S 102 and let the switch hang from its leads. Fasten the panel to the chassis, using ¼" screws in the old, right hand handle mounting holes. Holes for the new, shorting type phone jack and the vertical row of toggle switches should now be laid out and drilled. Drill a ⅜" hole in the location of the bottom, left hand handle mounting hole for the phone jack. Drill a ½" in the location of S 102. Lay out and drill one more ½" switch hole below and three more above this hole on 1 3/16" centers.

If desired, a vernier drive may be installed on the main tuning shaft as shown in the photographs. A 5 to 1 reduction unit with 360° dial was attached to the shaft and supported by the front panel.

Remove the panels, take them apart and clean up the rough edges and paint. When dry, reassemble the panels and mount on the chassis frame, using the component bushings and the previously mentioned ¼" screws. Mount the rf and audio gain controls in the holes provided. If standard ¼" shaft knobs are used, they will have to be modified to fit the odd size shafts used in the Autotune. The BFO shaft will have to be bushed out to ¼" diameter and the band switch and rf tuning knobs drilled out to fit the shafts.

The antenna connection is brought out the rear of the receiver to a coax jack through shielded cable. Punch some holes for ventilation.

1. Mount one of the former sub-panel mounting posts in the top center Autotune motor mounting hole. Saw the angle bracket of the pilot light assembly off flush with the socket mounting plate. Position the lights behind the dial scales, drill a hole and mount the assembly to the post. Connect the hot terminal to pin 11, P 103.
2. Attach the line matching transformer to the speaker and wire the secondary to the voice coil. Ground one side of the 300 ohm wiring. Mount the speaker and extend the hot lead to pin 14, P 102.
3. Transfer the leads from each section of S 102 to the new toggle switches, running a ground jumper between the phone jack and the AGC, Calibrate and BFO switches.
4. Remove the lead on pin 23, on the back of J 110 and connect to the terminal post marked E 102.
5. Run a two conductor shielded cable between the audio gain control and the vicinity of V 107, using existing cable clamps. It replaces R-151, 470K. The high terminal goes to C-134, .01 μf capacitor. The center goes to pin 4 of V 107 and the bottom is grounded.
6. Connect a 10 K ww vrf gain control between pins 17 and 18, P 103.
7. Connect jumpers on the pins of P 102 as follows: Chassis Ground to 12 and 16; 11 to 15; 20 to 21.
8. Connect jumpers on the pins of P 103 as follows: 1 to 22; 2 to 16; 12 to 18; 13 to 20; 14 to 15.

Check the work to insure that no wiring errors have been made. Silicon diodes can easily be destroyed before the line fuse blows. Use an ohmmeter and check for B+ shorts. If all seems well, plug it in. Advance the rf and audio gain controls and you should be in business. If the audio gain is insufficient for your requirements, connect 25 μf capacitors from pin 6 of V-107 to ground and from pin 8 of V-108 to ground.

A check on the calibration and alignment will probably show them to be slightly off. Remove the connector from P 301 on the high frequency PTO, turn on the BFO and Calibrate switches and advance the gain controls all the way. Set the BFO knob for zero beat, then loosen the gear that drives the dial scale and set it to "0" and tighten the set screws. With the dial still set at "0," reconnect the HF PTO, tune in a steady signal and adjust the six screws on the *if* slug rack for maximum output. Turn the band switch to band "A" and set the dial for zero beat with a 100 kc checkpoint. Loosen the coupling on the HF PTO and set the dial pointer precisely on the 100 kc calibration marker and retighten the coupling. Tune in a steady signal in the section of each band where maximum performance is desired and adjust the HF slug rack screws marked with the designation of the particular band. Adjust for maximum output and on bands "B," "E" and "F" touch up the trimmers on the right side of the chassis.

Two operating options are available with this receiver. The BFO may be tuned to the center of its range and all tuning accomplished with the front end tuning control or the HF tuning may be used only to set to zero beat with 100 kc check points and the BFO-*if* tuned across 100 kc bands. On bands "A" and "B," one revolution of the front end PTO shaft covers 100 kc. Calibration is accurate to within one or two kilocycles across the entire band. Equal accuracy and comparable stability exists on the higher bands but, since harmonics of the PTO are used, the dial may not be read as accurately. No deterioration of performance was noted when the front end is set on the check points and the *if* tuned. If this mode is to be used, the dial calibrations on the BFO scale will prove confusing. Two scales are provided to compensate for the fact that, depending on the band in use, the conversion frequency may be above or below the received singal. The scales are calibrated 50-0-100-50 and 50-100-0-50, with a dial mask geared to the bandswitch selecting the proper scale. In the original application the BFO was offset and the HF oscillator tuned to zero beat and the BFO then returned to "O." This results in the dial scales being reversed when the *if* is tuned. Perhaps the best answer is to remove the mask and to mentally select the proper scale for the band in use.

. . . W4WKM

If you'd like a schematic of the whole ARR15, 73 can supply one for 50¢. 73 Magazine, Peterborough, N. H.

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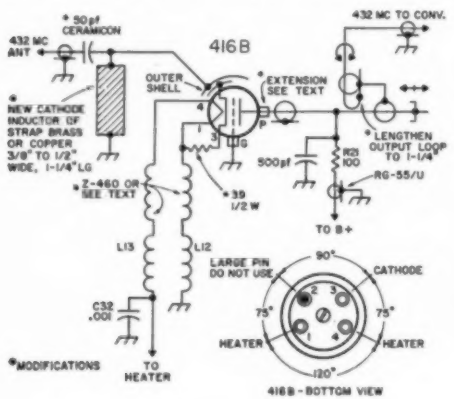
432 mc Preamplifier from the TD-2

Several articles published in *73 Magazine**, show the conversion information to enable one to change over to the WE planar triode 416B type tube for improved operation on 432 mc and 220 mc. Since the original efforts produced very good results other suitable pieces and parts of equipment that lend themselves very handily to the same process have turned up.

Many configurations of tank circuits around the 400 to 600 mc range of frequencies were used in both WWII and postwar equipments with such lighthouse tubes as 446A/B, 2C40, 2C43, 2C46, etc. In most cases, the dimensions of such tubes are such that the WE 416B gold plated triode can be adapted to the existing structures without too much difficulty.

This article will describe such a piece of equipment. It is a coaxial section of cavity contained in the surplus telephone company TD-2 microwave generator set. The TD-2 is now in surplus at a very attractive price (around $20.00) and is a valuable addition in parts alone for the VHF-UHF man. Various cavities that cross 1296 mc can possibly be salvaged along with many other useful items.



V5 CAVITY ONLY

Modified preamplifier.

The unmodified TD-2 generator starts with 17.5 to 19 mc crystals (VI) and progresses along the multiplier string which uses six more tubes (V2 thru V7) to reach the desired output of around 4,000 mc. Stages number 4 and 5 use 2C43 tubes and stages number 6 and 7 use 416B's. This TD-2 generator appears to have promise on 1296 mc and also possible use at its normal output frequency range of 4,000 mc as a pump source for paramps.

The cavity we're after is a quarter wavelength section of coaxial cavity associated with tube V5 and marked ED63913-30G1. This is one of the frequency multipliers and in its present form operates as a tripler from 208–211.2 mc to 624–633.6 mc. This is the cavity we shall modify as a straight through rf preamplifier for 432 mc.

Changes are rather simple and usually take only an hour or so to perform. Operation is surefire. There is really nothing much to go wrong with it. As in the previous conversions of equipments to use the 416B tube, this one will follow similar lines, that is, a few simple mechanical changes plus lowered plate and heater voltage to allow operation of the 416B tube without external air blowing on the seals.

Modifications

If possible, read the previous instructions contained in the reference articles, then proceed.

Since the cathode input circuit will no longer be operating at the 208 mc range, remove the coil L7 and capacitor C-9. In their place fashion a broadly resonant 432 mc copper strap inductor about 1-¼" long and ⅜ or ½" wide. Form it between the grounded grid ring assembly and the square rf cathode plate structure. Refer to the photograph and sketches. The antenna is tapped directly to this rf cathode structure through a 50 pf ceramicon capacitor. The original rf chokes are left in

*"Using the 416B and 8058 Tubes as 432 mc Preamplifiers in the Navy CFN-46ADT Converter," 73, June 1964.
"Using the 416B on 220 mc with the Navy CG-50ABN Preamplifier," page 52 this issue.

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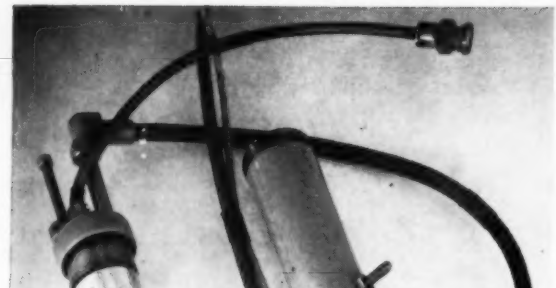


Exploded view of the modified V5 cavity from the Tell Co TD-2, 400 Mc generator. The insides screw into the cylinder. The input antenna coax is the one taped to the heater line. It terminates on the round grid ring and the inner connection goes to the series ceramicon capacitor, thence to the square cathode plate. The heater and cathode rf chokes may be seen as well as the cathode resistor. These components are slipped on to the 416B tube prongs with retrieved tube socket clips. The plate voltage is through the coax cable with the BNC connector on the end. The added circular disc is seen strapped to the inner conductor of the cavity up near the plate finger receptacle. The mating disc terminates in a screw driver adjusted screw in the outer wall of the cylinder cavity. Output coupling link is lengthened and can be seen quite clearly where it has been soldered to make the extension. Output rf signal is contained through the coax with the end open.

place, but two new ones are also added. Use Ohmite Z-460 units or about 13 turns of No. 22 enameled wire close wound on an ¼" form (about .2 μh.)

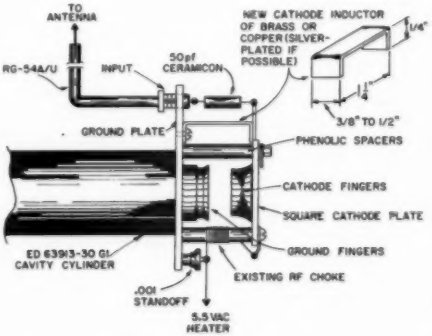
The original plate circuit is resonant at around 600 mc, so it will be necessary to bring down the frequency a bit. This can be done by adding a circular plate about ⅜" in diameter close to the plate end of the line. It may be secured to the inner conductor by a strap or by any other way you like. Arrange for a matching circular plate to mesh with the fixed plate. The wall thickness of the outer cylinder of the cavity is sufficient to thread for this variable plate. These small circular discs are plentiful items in most 432 mc junk boxes. The two discs may be left quite close together and the final tuning done with the original tuning screw which adjusts the shortening fingers inside the cavity or the tuning may be done with the variable circular disc. Suit yourself.

The plate line will not quite reach the plate connection of a 416B tube, since the 2C43 is slightly longer. It will be necessary to provide an extension. Using a piece of ¼" copper tubing about ¾" long, slit one end with a hacksaw and adjust the tension to accept the plate cap of the 416B. The other end of the tubing will now fit perfectly into the plate fingers that formerly engaged the cap of the 2C43 tube if the fingers are bent inwards just a bit.

The output coupling loop should be lengthened to about 1-¼" long or just about double the original length to increase the loading of the tube. Just form and solder on a length of bare tinned or silvered copper wire for this. The photograph shows this clearly.

The rf input from the antenna terminates in the unused "ear" projection of the ground disc. The inner conductor connects to the series ceramicon capacitor, thence to the cathode square plate. The existing couple of small tabs serve to hold the 416B tube firmly down.

Taped to the antenna coax input cable will be seen the heater line carrying the desired 5.0 to 5.5 vac. The plate voltage may be anything from 70 to 105 volts, preferably regulated. The plate current will be from 4 to 7 ma, according to the condition of the individual 416B tube used. The plate voltage arrives via the RG-55/U piece of coax with a BNC type plug on its end. This may be modified for anything you desire. It was left as is here at W5AJG.



Modified TD-2 cavity.

The tuning lead screw may be seen adjacent to this B plus lead. Here is where tuning adjustments are best made. The rf output that will go to the input of the 432 mc converter is the larger coax cable, type RG-54A/U. If you use UHF or type N plugs, connect on the end of this cable.

The cathode resistor is a 39 ohm unit which replaces the original 1500 ohm (R-8) one and this component as well as the heater leads are clipped on to the prongs of the 416B tube with tube socket clips.

Since the diameter of the grid ring of the 416B is of the same approximate diameter as the grid ring of the 2C43, perfect fit is obtained and very effective grounding is secured for the new tube. The cathode securing fingers on the underside of the square cathode plate may be bent inwards a bit and thus a secure fit will be obtained on this element of the 416B, which is ¾" in diameter as contrasted to 1" in diameter for the 2C43 tube.

Operation

Little need be said here. Voltages are set, connections to the antenna and input of the 432 converter are then made and the unit tuned to frequency with the circular tuning plate. A signal generator will be useful at this point, but lacking that, a 432 signal or even a bit of ignition noise may be employed. After the tuning disc is locked down, the lead screw at the rear of the cavity may be used to peak the frequency.

As has been expounded in the several articles regarding the proper tuning of such pre-amplifiers as this, an out of town weak signal is the best one can do, short of professional test gear. Nothing will take the place of a 432 mc buddy some couple of hundred miles who will put on his "V" wheel and let you have at it for a few minutes each day. This practice is universal around this area among the UHF boys and it is highly recommended. By alternately using the pre-amplifier and then going around it, one can tell very quickly if the score is favorable.

Some workers have stated that a small variable employed in place of the fixed 50 pf ceramicon as shown here was used to advantage. No improvement could be noted at this location, but it is certainly worth a try if you are so inclined.

No bragging will be done to finish off this writing. Four different types of 432 preamplifiers have been and are being used here at W5AJG, three using 416B tubes and one using 8058 Nuvistors. All give equally good results—by good results is meant a definite improvement in S/N ratio over not using them at all. As far as a statement about an absolute improvement in noise figure is concerned, this is beyond our capability at this time. After all, one might have a fantastically low noise figure (perhaps by accident) but be burdened with a questionable antenna or a rather poor uhf location and not even hear signals his good friend across town hears with just so-so receiving gear.

Quite often I find myself thinking that I am the unfortunate one. Don't we all?

. . .W5AJG

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VHF

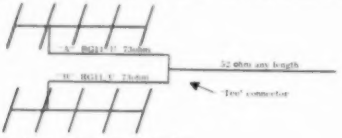
In the May column I said we would discuss antenna stacking and matching this month. Refer to that column for a coaxial feedline loss chart.

Placing two identical antennas side by side, or one above the other, will increase the gain over a single beam by 3 db, the same as doubling your transmitted power. This increase also applies to receiving.

In other words, if a single beam has 10 db gain, stacking two of them would yield 13 db and four beams in a quad would bring the gain to 16 db.

The longer the boom, the further it should be stacked for proper operation. Two four element two meter beams should be separated 82"; six elements, 107"; eight elements, 120" and ten element beams 132". So you can see there is no precise stacking distance. It depends on boom length and the number of elements.

There is an easy way to stack two 52 ohm antennas,



Length of "A" and "B" in inches

Freq:	5/4w	7/4w	9/4w
144 mc	67.5	94.5	121.5
145 mc	67.0	93.8	120.6
146 mc	66.5	93.1	119.7
147 mc	66.0	92.4	118.8
148 mc	65.5	91.7	117.9

"w" is wavelength

using 73 ohm coax. Below is a diagram and the mechanical lengths of the coax. Do not alter the lengths. The velocity factor of the coax has already been considered.

You will note the 73 ohm harnesses are in odd multiples of ¼ wave-lengths. If other than these figures are used the linear transformer will not properly reduce the input to 52 ohms.

Since this harness allows any two identical 52 ohm antennas to be fed with a single 52 ohm line, it is obvious another harness in exactly the same manner would feed four antennas each connected by a single harness to a final harness. If you do stack antennas, be SURE that the braid of each feeder goes to the same side of each antenna or you will have a pattern that can't be found in any handbook!

We have purposely used two meters but the arrangement holds true for any frequency if the feeders are cut proportionately.

(Tnx W9HOV; Gain, Inc.)

The Midwest VHF Meeting, held in Sioux Falls, South Dakota brought in over 80 VHF'ers from both Dakotas, Minnesota, Iowa, Nebraska, Illinois, Michigan and Canada.

Featured speakers were Sam Harris W1BU/W1FZJ; Bill Roberts W9HOV; Clarence Hunter of Galaxy Electronics (they will begin marketing a 6 and 2 meter full-coverage, SSB, CW and AM transistorized transceiver in August: Write Alan McMillan at WRL for details) and Charles Compton WØBUO, Dakota Division Director of the ARRL.

I hope this get-together will not die and that another midwest group will consider a similar meeting for next year.

Please send in your short articles, circuits and so forth. If you will send them to me directly we can avoid a delay in getting them into print.

. . . KØCER

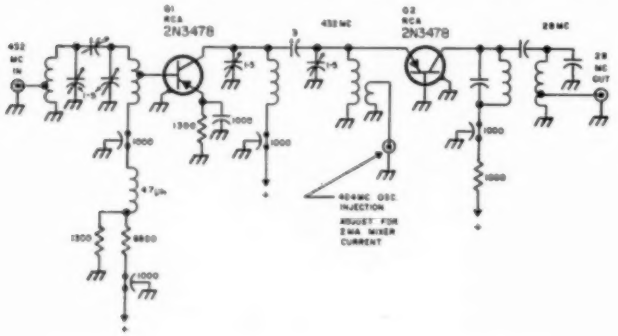
SEMICONDUCTORS

The biggest news in semiconductors this month is the RCA 2N3478. This $2 transistor is the hottest thing you'll find for 432 mc. W1OOP first mentioned it, then a trip to W1BU really convinced me. Sam has a single 2N3478 mixer with a 7 *db* noise figure. Compare that with complete tube-type converters: one of the best that Sam has seen uses a couple of $14 8058 rf stages plus mixer in a complex, space-consuming, power-hungry converter. It has a NF of 7.5 db. A 2N3478 mixer alone will beat that and give you a simple converter to get going on 432 mc. Adding a 2N3478 rf amplifier brings the noise figure down to 4 db. You won't beat that unless you use a parametric amplifier as Sam does.

A few notes on the converter. The mixer is in grounded base class C. It draws no current unless you apply local injection or a strong signal to it. Adjust the injection for about 2 ma collector current with no signal. The version shown uses double-tuned circuits in case you have UHF neighbors. You can use simple coils if you live in the sticks, or coaxial circuits if you live in Medfield. Thanks to W1BU; I traced the circuit from one of his converters. I'm building my own now and will let you know how it turns out.

The Fairchild line of inexpensive silicon transistors, like others discussed last month, is ideal for ham and commercial applications. They have transistors for all uses. A number of hams have tried them out with excellent results. A good example is the PNP 2N3638. It's billed as a 2N404 replacement at the same price—46c. But it's silicon rather than germanium, so offers many advantages over the 2N404: heat resistance, electrical toughness, more uniform characteristics. This transistor is an excellent general purpose unit. You can use it for switching and logic circuits (as in electronic keys), audio and even low level rf. Another Fairchild transistor is the 2N3635 for audio use, but K1MFQ even uses one as a varactor to get local injection for 432 mc converters. We hope to hear more from him on that.

K8AOE writes that he has been using the inexpensive Texas Instruments TIXM05, 6 and 7 (mentioned last month) in grounded base converters for 6 and 2. He's very happy; noise generator comparisons indicated that his converter is better than a well-known commercial converter on 2.



K8ERV asks for single quantity prices. I'll give them when I can find them. But there's usually no more than a 2 to 1 spread between single prices and 10,000-quantity prices. If the quantity price is $1, you shouldn't have to pay more than $2 or so.

Next month I'll discuss the parameters manufacturers use in rating transistors. Until then, don't forget to write. We're particularly interested in what transistors you've been using and what results you've had.

Paul Franson WA1CCH
73 Magazine
Peterborough, N. H.

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PS150-120	90.	HQ1J0	$135.	99er	99.	**NATIONAL**		GC105	$206.
PS120	75.	HQ110C	140.	**E. F. JOHNSON**		HRO50T	$165.	Com. VFO	64.
HT40	75.	HQ110AC	175.	Ranger I	$115.	NC155	125.	GR211	50.
SX140	75.	HQ180	300.	Ranger II	239.	NC270	150.	**P & H**	
HT41 (new)	310.	**GLOBE**		Challenger	75.			LA400C	$135.
HT41	270.	Champ 300	$100.	KW Match Box	130.				

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New Products

New Skylane Quad

Skylane Products has introduced a new member to their excellent line of quads. The new quad is a four element array that boasts many advantages over quads with fewer elements; it features greater gain, better F/B ratio and a much sharper horizontal field pattern. Input impedance is approximately the same as the three element quad. The SWR is less than 2 to 1 at any place in any band for which the quad is designed and is approximately 1-1 at resonance . . . in other words, just what might be expected by adding another element to the already famous Skylane three element quad. Write for new catalog with complete information from Skylane Products, 406 Bon Air Drive, Temple Terrace, Florida.

EICO Bridge Analyzer

EICO has a new one-instrument lab that does about everything possible in a lab. It's called the 965 FaradOhm Bridge-Analyzer. Among its uses: R-C bridge, R-C-L comparator, capacitance leakage/I-R analyzer, a DC VTVM and a DC nano-micro-milliameter. This one will do the work of many other instruments for the lab, experimenter or serviceman. It's available wired and tested for $129.95. Write EICO, 131-01 39th Ave., Flushing, N. Y. for more details.

Low Priced Veroboard Kit

Vero Electronics has an interesting new product, the Veroboard Breadboard Kit BK-6. This kit consists of six assorted Veroboard Universal wiring boards, a Vero spot face cutter and complete instructions on how to design a component layout directly on this unique new wiring board. With a Veroboard, you don't need a chassis, bracket, terminals, tools or wires. The basic construction kit is all you need to breadboard experimental circuits or make a finished circuit board. The Veroboard Breadboard kit BK-6 is available from Vero Electronics, 48 Allen Blvd., Farmingdale, N. Y., for $5.95 delivered.

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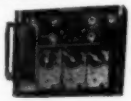
10 channel, crystal controlled, autotune. Internally complete, with all tubes, less 24v dynamotor. With schematic, conversion book. Excel. used (35) **$25.00**



R77/ARC3, 100 to 156 MC Receiver

8 channel, crystal controlled. Easily made tuneable. Internally complete, all tubes, & Schematic. Excel. (35) **$17.50**

T67/ARC3, 100 to 156 MC Companion Transmitter

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FAMOUS Q5-er. with 85 KC IFs, Internally complete, 6 tubes. Used, (nicest I've seen in years). (12) **$15.50;** w/dyna. (15) **$16.00**

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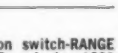

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250	☐ 2.25	☐ 2.95	☐ 3.25
300	☐ 2.69	☐ 3.19	☐ 3.50
350	☐ 2.95	☐ 3.59	☐ 4.25
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☐ 2N2060	2	60 to 150	—
☐ 2N1132*	2	35 to 90	100

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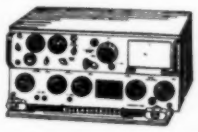

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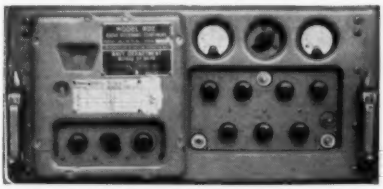

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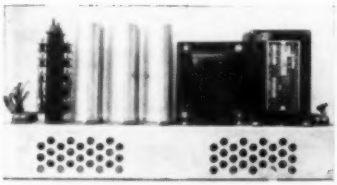
$125.00



SOLID STATE REGULATED FILTERED power supplies, made for 19" panel mount although not all have panels affixed. 115 volt 60 cycle input. Picture above shows typical layout. Offered as a SURPLUS SPECIAL.

5 VDC	4 amp	**$20.00**
10	2	**20.00**
15	7	**25.00**
20	4	**20.00**
20	20	**25.00**
35	2.3	**20.00**
150	6	**25.00**
200	300 ma	**20.00**
3 volt 6 amp, 6 volt 3 amp		**25.00**

TRANSISTORIZED REGULATED SOLID STATE supply made by LFE. 19 Inch rack panel mount. Two models, 115 volt 60 cycle input. Output variable 25%.

28 volts DC 500 ma	**$30.00**
28 volts DC 1 amp	**35.00**

CQ's NEW Conversion Book **$3.00.** Pages of surplus Conversions plus 3 articles on ART-13.

Meshna's new Spring catalog now ready. Send 20c for yours before they are all gone.

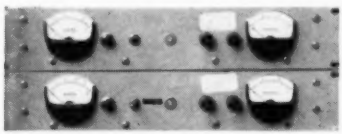
SNIPERSCOPE, M-3, late model, permits viewing in total darkness. Ready to use, includes 20,000 volt power supply. You furnish 6 volts DC to operate. Used, checked out. Rifle shown in picture not included.

$225.00

HEAT SINK, ALUMINUM, DOUBLE FIN. With 150 watt transistor 2N277

1.5x4.8 inches **$1.50** Without transistor **50c**

3.5x4.8 inches **$2.50** Without transistor **$1.00**



TRANSISTORIZED REGULATED SUPPLIES. 115 volt 60 cycle input. Two 19 inch supplies bolted together, cooled by one fan. Solid state rectifiers. One supply rated at 7-9 volts adjustable at 2 amps DC. The other 7-9 volts DC 12 amps adjustable. Mfd by HYPERION. Both supplies **$70** the pair.

---

29 VOLTS DC 50 AMPS

Solid State, filtered. 5% ripple, regulated output. 115 volt 60 cycle input, 19 inch rack panel.

$65.00

1600 VOLTS DC 1.8 AMPS

A tremendous bargain in a solid state filtered, regulated power supply. 115 volt 60 cycle input, 19 inch rack panel mount.

$75.00

MESHNA

19 ALLERTON ST., LYNN, MASS.

All Material F.O.B. Lynn, Mass.

MAKE A MILLION

We have in stock several Mobile Radar Units which are capable of tracking airborne objects at a range o 500 to 70000 yards. This is one of the most versatile units ever manufactured. Can be modified to equal th latest units available. Pricing and additional information available on request.

Volt Ohm Meter
A.C. Voltage
15, 150, 1000
D.C. Voltage
15, 150, 1000
D.C. Current
150 ma
Res.
100K Ohms
With Batt & Test Leads
$5.95

Volt Ohm Meter
20K Ohms per Volt
A.C. Voltage
0, 10, 50, 250, 1000
D.C. Ohms per Volt
0, 5, 25, 125, 500 & 2500.
D.C. Current
0-250 mil
0-50 microamps
Ohms.
0-10,000 & 1 Meg.
$13.95

S.W.R. Bridge &
Field Strength Meter
52 Ohm Imp.
Bright V-U Meter
Telescoping Ant.
$10.95

1½ Volt Ni-Cad Batt. .49c
Charging unit $1.49

LIMITED QUANTITY BARGAINS

GR 648A Strobolux	$89.0
GR 614C Selective Amplifier	69.0
Lambda 281M Power Supply	89.0
Tektronic 517 w/Power Sup & Cart	475.0
TS-175/U Freq. Meter 85-1000mc/s	129.0
BC-221 Freq. Meter 125-20,000kc	75.0
TS-34A/AP Scope	49.0
TS-35/AP X-band sig gen.	29.0
TDQ Xmitter—115 to 156 mc 45 watts	129.0
RBL Receiver 15 to 600 kc	69.0
RAO Receiver 540 to 30,000kc	89.0
SPR-2 Receiver 1000 to 6000 mc	89.0
BC-342 Rec. 1.5 to 18 mc. 6 bands	79.0
BC-348 Rec. 200 to 500 & 1.5 to 18mc.	89.0
TS-155/C Sig. Gen. 2700 to 3400 mc.	129.0

Silicon Rectifiers

1N1446	.075A	100V	.15
1N1447	.075A	200V	.25
1N1448	.075A	300V	.35
1N1449	.075A	400V	.45

0-130V 5Amp Voltage Regulator
Fully Enclosed
Rugged Construction
$14.95

PUSH-TO-TALK MIKE
Low Impedance
Cord
$3.95

T-26 Carbon Mike
W/switch & 8 ft. cord
$1.49

KY-65 Keyer
Complete with code
Wheel
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Magnesyn Compass System Indicator, Transmitter
12 Volt Inverter & Manual
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TUBE TESTER XFORMER
PRI: 115 V. 60 Cyc
C.T. 320 V. .015 Amp
Taps: 1.1v @ .25a—1.5v @ .22a —2v @ .26a—3v @ 3a—4.3v @ 3a—5v @ 5a—6.3v @ 1.25a— 7.5v @1.25a—10v @ 1.25a— 12.6v @ 6a—25v @ .3a—35v @ .3a—50v @ .3a—75v @ .15a —117v @ .09a—5v @ .002a
$3.95

F-1 Carbon Mike Button
.69c 10 for $5.00

F.1 Handset With F-1 & HA-1
$1.49

HEADSETS:

HS-23	2000 ohms	$4.95
HS-33	600 ohms	5.95
HI-FI	Headset 600 ohms	9.95

4 BAND SUPERHET RECEIVER
* Band Spread & "S" Meter
* Dial Circuit
* Slide Rule Tuning
* Band Spread 0-100 Calibrated
* Power Output 1.5 Watt

Band 1: 535KC-1,650KC
Band 2: 1.6Mc-4.8Mc
Band 3: 4.8Mc-14.5Mc
Band 4: 11Mc-30Mc
$49.95

SPEED-MASTER BUG
* Precision Built
* Professional Type
* Semi-Automatic
* Transparent Cover
* 8 Tension & Speed adjustments
* Adjusts upward from 10 WPM
$10.95

Sound Powered Handsets
No batteries required
$10.95 2 for $20.00

BC-639 Receiver
100-156 MC Tunable
With External Power Supply
AM, CW & MCW
1 Watt Output
600 Ohms Imp.
$85.00

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475B Tunable Bolometer Mounts, 1000 to 4000mc, 0.1 to 10mw, $200.00 new $39.50
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667A Inductance Bridge 135 00
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801A Klystron Power Supply 195.00
650 Universal Power Bridge 89.50
275 Standing Wave Amplifier 89 50
904 VHF-UHF Noise Generator 49.50
852/854 X-Band Spectrum Analyzer 249.50

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"Kilo Q" Q-Meter, 20 cps to 200 KC. 139.50
Mega-Pix, Channels 2 to 13 ..... 139.50
Mega-Match, 10 to 250 Mc, 30 Mc. Sweep 139.50
Ballantine 300 VTVM, portable or Rack Mount 44.50
Millivac MV-18 VTVM, RF voltmeter, DC Millivoltmeter (Less Probe) 59.50
Sierra 101 Carrier Freq. Voltmeter 95.00
Sierra 158 H.F. Wave Analyzer 500kc-10mc 125.00
Sperry Microline 444 Klystron Signal Source 175.00
Electropulse (Servo) Model 2120A Pulse Generator, 0.5% accuracy, 0.02% jitter, 0.02 micro-sec rise time, Pep Rate 10cps to 100Kc, Delay 10,000 micro-sec. $1800 value 250.00
400 CPS Generator, 60 CPS 3 phase input, 4 KVA 150.00
ITECO "Phazor" Phase Meters Model 200AB, 20 to 30,000 cps, Accuracy 2%, measures phase shift in amplifiers, transformers and filters, measures 0 to 360 degrees 125.00
Freed L-C-R Comparison Bridge 29.50
Sarkes Tarzian F-6 Sil. Rect. (1N2484), New, 600 PIV, 750 Ma. ..... 10 for $3.75
RCA Sil Rect. 1N3254, New 400 PIV, 750 Ma. ..... 10 for 2.50
Microammeters, 2" 0-500 micro-amps 2.25
Dial Plates, 1⅞" dia. Aluminum, Nos. 1 to 100 in 180 degrees ..... $1.00 /doz.
2 Meter Band Pass Filter, Coax, Heavy Brass, Silver Plated, H-Q, Eliminates TVI, Surplus Special, While They Last. 5.95
JFD Piston Trimmer Caps, Type QS-173, Panel Mount, 0.6 to 5.5 mmf, $8.25 value each. New original pack ..... 20 for 9.00
4" National "Velvet Vernier" dials, good used, 5 to 1 ratio 1.75
Telescoping Antennas, 11 in. to 6 feet, Lightweight 0.75
Power Transformer, 350-0-350, 180 Ma, 12.6V, 10A. 6.3V, 3A. 5V, 3A. Shipping Weight 10 lb. FOB 3.50
Dura-Mica Capacitors ..... 20 for $1.00, $4.50 C, $35.00 M

Cap. mmf	%Tol.	Cap. mmf	%Tol.	Cap. mmf	%Tol.
4.7	5	47	5	390	2
6.8	2	100	10	750	2
10	5	120	5	1000	2
18	0.5	180	2	1800	5
20	2	185	2	2000	5
33	5	300	2	3900	5

4CX300A—Pullouts, Guaranteed good 11.50
7457 RCA, Pullouts, Guaranteed good for moon bounce 6.50
2C46 Pullouts, Guaranteed good for moon bounce 1.35
Snap Button Hole Plugs, ⅜", ½", ⅝" ..... 50 / 1.00
Glazed Ceramic Standoff Ins. ⅝"H. ½"Dia. 8-32 thd. ..... $1.00 /doz. 6.50 /C
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Oil Filled Bathtub Caps, 0.5-200v ..... $6.50 /C, $45.00 /M FOB
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ALL EQUIPMENT FOB RED BANK, N. J.
ORDER UNDER $5.00 Pack and Post 50c

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SPECIAL—DELUXE—ENCOR—STANDARD 19" RACK

EXCELLENT FOR TELETYPE
18"x23" TABLE ATTACHED TO RACK
FULL DOOR IN REAR
ROUNDED CORNERS AND EDGES

LARGE SIZE 69" HIGH
23" WIDE
22" DEEP — PRICE $39.95

SMALL SIZE 52" HIGH
23" WIDE
22" WIDE — PRICE $29.95

BOTH RACKS ARE ON CASTERS, AND INCLUDED IN PRICE. ALL PRICES F.O.B. PHILA.

DIRECT PLUG IN REPLACEMENT (COMPENSATION NET WORK BUILT-IN.)

5R4	Price: $3.95	#5C
OZ4—6X5 REPLACEMENT	Price: $1.95	#5E
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POWER TESTED SILICON RECTIFIER UNITS

(1 amp. @ 1 ma. max. leakage)

50—200 PIV	price	6c ea.
200—400 PIV	price	14c ea.
400—600 PIV	price	24c ea.
600—800 PIV	price	36c ea.
800 or better	price	44c ea.
1000 PIV	price	54c ea.

POWER TESTED SILICON RECTIFIER UNITS

(All 5 amps)

200—400 V	price	39c ea.
400—600 V	price	49c ea.
700 V	price	69c ea.
800 V	price	84c ea.
1000 V	price	$1.99 ea.

All prices are F.O.B. our warehouse Philadelphia, Pa.

All merchandise accurate as to description to the best of our knowledge.

Your purchase money refunded if not satisfied.

TERMS: Our terms are cash. All trade and cash discounts have already been deduced in our catalog quotations.

Minimum order — $3.00

POWER TESTED SILICON RECTIFIE UNITS

(All 35 amps)

50 V	price	.84 ea.
100 V	price	.92 ea.
200 V	price	1.94 ea.
300 V	price	2.68 ea.
400 V	price	2.99 ea.
500 V	price	3.28 ea.
600 V	price	4.08 ea.

TUBULAR HIGH CAP. ELECTROLYTICS

cap.	w.v.d.c.	price	2 for	Cat.
20,000	MFD 25v.	$ .95	$1.50	S-71
25,000	MFD 25v.	1.25	2.00	71
20,000	MFD 30v.	1.25	2.00	71
40,000	MFD 10v.	.95	1.50	71
40,000	MFD 30v.	1.75	3.00	71
8,000	MFD 55v.	.95	1.50	71

RDZ POWER SUPPLY

D.C. power supply mfg. for MARS or RDZ receiver, Input 115 v.a.c. 50/60 cy. Output 30 v.d.c. @ 200 ma well filtered thru two 8 hy 200 ma chokes and two 10 mf capacitors thru a VR-150. 6.3 v.c.t. @ 10 amps and 12 v.a.c. @ 3 amps. Meas. 5½" x 9" x 17". Complete with tubes. Shpt. wt. 65#.

PRICE ONLY: $14.95 ..... S-6262

SUPER PRO POWER SUPPLY

Rack Mounted ..... Excellent condition.
Shpt. wt. 60# ..... Price: $19.95 ..... S-6609

APR—1 TUNING UNIT

30 to 90 mc. TN-1B
Easy converted to 6 meters.
BRAND NEW. Shpt. wt. 26#
S-7131 ..... $14.95

AERIAL WIRE

Reel contains approximately 138 feet of phosphor bronze, no. 16 stranded, 200 lb. ttst antenna wire. Has galvanized clips on ends. Brand new.

Shpg. Wt., 3 lbs.
Cat. No. S-6313 ..... $1.50, 4 for $5.00

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HO 8-7891 — HO 8-4645

SELECTRONICS

420 MC TRANSCEIVERS

The same as one we sold for $34.95 except the vibrators, 5894A, cables and mike are missing. Most of the small tubes are included. These units are excellent for stripping and using the tripler-amplifier chassis to get on 420 mc with about 2-3 watts drive on 2 meters. Type 8236 tubes may be substituted for the 5894 at reduced output. Cat. #S-7129. Price $9.95

MODEL WR-36A

Produces black and white dots, color rainbow pattern, and a 3.58 mc subcarrier for alignment and adjustment of color receivers. Has RF output for insertion of signal into receiver antenna terminals and video output. In excellent condition. Shpg. Wt., 30 lbs.
Cat. No. S-6998A $24.95

FILAMENT TRANSFORMERS

Pri. 115 or 230 v. 60 cy. Sec: 6.3 v.c.t. at 6.5a. Cat. #S-7119. Price $1.00

DO IT YOURSELF KIT

K. V. Silicon Rectifier assembly kit—consisting of diodes and resistor capacitor network. Full assembly instructions included. Can be used in either full wave center tap or full wave bridge configuration—up to 3500 volts at 1 amp. $19.95
Higher power kits or custom built units available on request.

POWER TRANSFORMERS

1000 V.C.T. @ 275 ma. 105-125 Volts input 60 cy.
1 each 6.3 V @ 10 amps. 2 each 5 V @ 4 amps.
Price: $4.95 ..... S-7140
Shpt. wt. 11#

TUBE REPLACEMENTS

DIRECT PLUG IN REPLACEMENT. NO RE-WIRING NECESSARY. At least 60 V more B+ and current capabilities up to 1 amp. D.C. for item #5A.

Replace the following tube types #5Y3, 5U4, 5Y3G, 5Y3GT, 5V4, 5V4GT, 5AU4, 5T4, 5W4, 5Z4, 5AW4, 5V3, 5AS4, 5AX4, 5AZ4.
PRICE: $1.95. ITEM #5A

COAX CONNECTORS

SO-239 ..... Price: 6/$1.00
PL-258 ..... 35c ea. 3/$1.00

All prices are F.O.B. our warehouse Philadelphia, Pa.
All merchandise accurate as to description to the best of our knowledge.

Your purchase money refunded if not satisfied.

TERMS: Our terms are cash. All trade and cash discounts have already been deduced in our catalog quotations.

Minimum order — $3.00

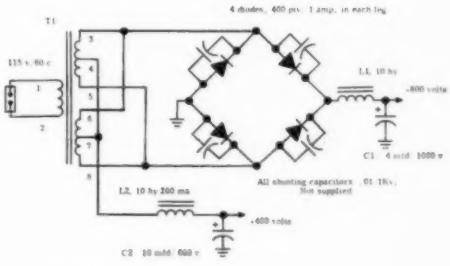
TRANSFORMERS

Pri. 115 V 1 ph. 60 cy.
Sec. #1 6.3V C. T. @ 20 amps.
Sec. #2 8V @ 1 amp.
PRICE: $3.50 ea.

Pri. 115 V 1 ph. 60 cy.
Sec. #1 6.3V. C. T. @ 0.6 amps.
Sec. #2 6.3V. @ 2.25 amps.
Sec. #3 6.3V. C. T. @ 2.4 amps.
Sec. #4 6.3V. @ 22 amps.
PRICE: $4.50 ea.

BRUTE POWER SOLID STATE SUPPLY KIT

Husky mil. spec. transformer—choke combination to supply HI & LOW Voltage at plenty of current for any of the modern 150-300 Watt P.E.P. Transceivers or Exciters. At full rated current (300 mils or better) regulation better than 10%. Full instuctions and schematic included.
PRICE: $24.95. Shpg. wt. 40 lbs.


4 diodes, 600 piv, 1 Amp. in each leg
T1
115 v. 60 c
L1, 10 hy
-800 volts
C1 4 mfd 1000 v
All shunting capacitors .01 1Kv. Not supplied
L2, 10 hy 200 ma
+600 volts
C2 10 mfd 600 v

METERS

0-1-	MA D.C.	2½" Rd. Rugg.	@	$2.95
0-5-	R. F. amps	2½" Rd.	@	2.95
0-2-	R. F. amps	2½" Rd.	@	2.00
	(Thermo couple)			
0-15-	V.A.C.	2½" Rd.	@	1.49
0-50	MA.	2½" Rd. Rugg.	@	2.95

POWER TRANSFORMERS

Pri: 115V 60 cy. 1ϕ.
Sec. 1800-0-1800V RMS @ 300 Ma DC C.C.S. (in full wave choke input system).

BRAND NEW open frame mtg.
Shpt. wt. 20#
S-6550 ..... $27.95

RG 8/U COAX CABLE

17' L. with type N connectors each end. UG 21 C/U. NEW.
PRICE: $2.00

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R-23/ARC-5 Receiver. 190-55 kc. Ex. cond. **$14.95**

R-26/ARC-5 Receiver. 3-6 mc. Ex. cond. **14.95**

R-27/ARC-5 Receiver. 6-9.1 mc. Ex. cond. **14.95**

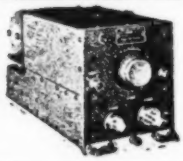
Metal spinner knobs. Each **1.95**

ARC MODEL R-22 BROADCAST BAND COMMAND RECEIVER
550-1500 kc. 28 v. Ex. cond.
$24.95
Tuning box for above with dial. **$2.95**

AN/ARC -5 COMMAND TRANSMITTERS

The Command Series group of transmitters is one of the most popular series of surplus transmitters in use today. They are extremely versatile and easily adapted for voice or CW putting out 50 watts.

T-18/ARC-5 2.1-3 mc. New. **$7.95**
T-19/ARC-5 3-4 mc. Ex. cond. **9.95**
T-20/ARC-5 4-5.3 mc. New. **7.95**
BC-457 4-5.3 mc. New **7.95**
BC-458 5.3-7 mc. Ex. cond. **5.95**
MD-7/ARC-5 Plate modulator. Ex. cond. **5.95**
BC-456 Screen modulator. Ex. cond. **3.95**



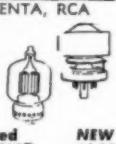
ARC Q-5'er
Model R-11A.
28v. 190-550 kc.
$19.95
Excellent condition.
Late commercial model

LATE MODEL **TELETYPE. 14FRXD TD** AND **REPERFERATOR COMBO**

Features sync motor, creep head TD. See February 1964 CQ for more details. This unit replaces the older type TD model 14 reperferator and it saves space. Ex. cond. Non-typing. Not tested. **$75.00**
Add $25 for overhauled and guaranteed units.

BRAND NEW EIMAC, PENTA, RCA

TRANS-MITTING TUBES



NEW	Fully Guaranteed	NEW
2C39A/7289 $9.95	4X502B	14.95
3B28 2.95	4CX300A	19.95
4-65A 9.95	807	1.50
4-125A 19.95	810	14.95
4-250A 24.95	811-A	5.95
4-400A 24.95	813	12.95
4X150A 9.95	872A	5.95

AN/ARC-7 Two meter walkie talkie. Easy to convert. Good condition. **$14.95**
2 for $25

HS-33 600 ohm
Headset. Brand new. Not surplus.
$6.95
$20.00 value with large chamois cushions add **$3.**

Columbia Electronics
4365 W. PICO BLVD.
LOS ANGELES, CALIFORNIA 90019
Phone 213-938-3731

T-19D MICROPHONE

Brand new. $9.95

The T-17D is a very sensitive press to talk 100 ohm carbon single button microphone for use with practically all military radio sets. Complete with 5 ft. cord and PL-68 plug.

RS-38 MICROPHONE

Brand new with coil cord.
$9.95

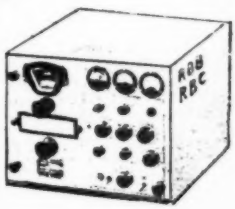
The RS-38 is a compact press to talk 100 ohm carbon hand microphone. This mike can be used in place of the T-17-D mike. Complete with 5 ft. cord and pl-68 plug.

TELETYPE EQUIPMENT

All complete and visually inspected but not checked out electrically.
Add $50 for overhauled and guaranteed units to prices below.

Model 19 teletypewriter set as shown above. **$165.00**
Model 15 page printed with keyboard. **99.50**
Model 14 typing reperforator
with keyboard **69.50**
less keyboard **49.50**
Model 14 transmitter distributor cipher **29.50**
All above equipment for 110 v ac 60 cps operation.

RBB & RBC COMMUNICATIONS RECEIVERS



RCA for Navy use. Sensitive and stable freq. range RBB 500 kc to 4mc RBC 4-27 mc in 4 bands. Tube line up 6SK7 1st RF. 6SK7 2nd RF. 6AB7 Oscillator. 6AB7 1st Det., 3-6SK7 IF amps. 6AB7 BFO. 6H6 AVC. 6H6. Noise Limiter, 6SK7 1st AF. 6SK7 Squelch, 6AB7 2nd AF. 6K6 Output. 5U4 Rectifier, VR-105 Regulator IF Freq. 400kc power unit input 110v. AC. 60cps. has following controls: Tuning, RF Input. AF Output, Selectivity 3 Positions, Squelch, MVC, CW, AVC. Ant. Trimmer Direct Reading Freq. Dial and Loging Scale. Input & Output DB Meter & V Meter

Receivers Be'ow Checked Out
RBB Receivers with pwr supply Ex. Cond. **$75.00**
RBC Receiver with pwr supply **95.00**

Model RBA
Almost same as above but tunes 15-600kc in 4 bands. Direct reading. Uses sensitive TRF circuit: Ideal for labs wishing to receive the new NBS station on 60kc. Same size as RBC. With pwr supply, Ex. Cond. **$95.00**

SELL US ALL YOUR SURPLUS HIGHEST PRICES PAID.

Contact us to find out. We pay all freight charges. We need BC units, AN/ARC-27, 34, 44, 52, SP-600JX, R-390, 388, 389, TG-7B, TED, URT-7, URR-27, 35, GRC, PRC, VRC, TCS, TRC-1, and UP, SG-1, 2, 4, 12, test equipment, Tektronix, HP, GR, ARC, Collins, Bendix aircraft equipment and many more. Tells us what you have available. It may be worth more than you think.

CRYSTAL ETCHING AND GRINDING KITS

These kits contain the following materials,

Kit #1
12 - Crystals in Misc. holders
6 - Assorted crystal blanks
1 - Pkg. Ammonium Bifluoride flakes
1 - Packet grinding compound
2 - Plastic containers
2 - Wooden crystal blank holders
Instructions

ONLY $3.95 postpaid USA

Kit #2
20 - Crystals in Misc. holders
12 - Assorted crystal blanks
Large package Ammonium Bifluoride
Large packet of grinding compound
3 - Plastic containers
4 - Wooden crystal blank holders
Instructions

ONLY $7.50 postpaid USA

Kit #3
35 - Crystals in Misc. holders
15 - Assorted crystals blanks
Extra-large package of Ammonium Bifluoride flakes
Extra large packet of grinding compound
5 - Plastic containers
2 - Plastic spoons
6 - Wooden crystal blank holders
Instructions

ONLY $12.50 postpaid USA

Signal Corps Technical Manuals, Instruction books and other material pertaining to signal corp equipment and etc. Manuals are New or like new. All are shipped postpaid USA. If faster means desired, add additional money to cover cost. All shipped parcel post otherwise. Due to size and weight of some manuals, a higher price is asked.

TM 11-2234 Teletypewriter TT-4/TG $1.50
TM 11-352 Printer TG-7-7-A and Teletypewriters TG-7-B and TG-37-B $1.50
TM 11-2230 Teletypewriter Sets ANF/GC-20, AN/FGC-20x and AN/FGC-21 ..... $2.00
TM 11-2246 Teletypewriter Sets AN/FGC-25 and AN/FGC-25X $3.00
TM 11-2210 Teletypewriter TT-10/FG $1.50
NAVY TECHNICAL MANUAL—Teletypewriters TT-47C/UG, TT-48B/UG, TT-69B/UG, TT-70C/UG, TT-128A/UG, TT-129A, TT-130A, TT-131A/UG, TT-171/UG, TT-234/SGA-3 ..... $3.00
TM 11-957 Rectifier RA-87 (Teletype pwr supply) $1.00
TM 11-264A Radio Set AN/GRC-26A (BC-610 schematic, H&I R-388/URR schematic, Freq. Shift Exciter Schematic $1.50
TM 4-602C Radio Set AN/ARC-27 ..... $2.25
Manual Illustrated Parts Breakdown Radio Set ARC type 12 ..... $2.50
TM 11-605 Radio Sets SCR-509 and SCR-510 ..... $1.25
TM 11-517 Radio Set AN/ARC-44 ..... $2.50
TM 11-851 Radio Set SCR-244-D & Radio Receivers R-274A/FRR, R-274C, R-320A/FRC, R-483/FRR and R-483A Rep-600 schematic $2.25
Instruction Book Radio Transmitter T-278/U and T-416/GR $1.50
TM-11-2671 Radio Transmitters Type 96A, 96C & 96C3 Wilcox $1.75
Instruction Manual Radio Receiver R-392 ..... $2.50
Instruction Manual Radio Set AN/GRC-19 ..... $2.50
TM 11-5054 Speech Amplifier BC-614-E-F-H and I $1.50
Instruction Manual Radio Set AN/GRC-10 ..... $3.00
Instruction Manual Radio Sets AN/VRC-19-19X-19Y $1.50
TM 11-621 Radio Set AN/GRC-41 ..... $2.00
TM 11-1367 Radar Set AN/MPQ-4A $2.00
Instruction Manual VHF Navigation Equipment ARC Type 15F $2.50
TM 11-300 Frequency Meter Sets (BC-221) SCR-211-A-B-C-D-E-F-J-K-L-M-N-O-P-Q-R-T and AA-AC-AE-AF-AG-AH-AJ-AK-AL $1.50
TM 11-2004 Repeater Set TC-18 (Terminal Telegraph) $1.25
TM 11-2202 Manual Telephone Switchboard SB-22/PT $1.50
TM 11-4313 Switchboards BD-91-A-B-C-D $1.25

Large Listing available for 10c coin-stamps

QUAKER ELECTRONICS

P.O. BOX 215 HUNLOCK CREEK, PENNA.

CRYSTALS IN SUB-MINIATURE HERMETICALLY SEALED HC-18/U METAL HOLDERS. Half the size of a HC-6/U crystal. These crystals have wire leads 1½ inches long. CRYSTALS SELL AT $1.05 each postpaid USA. Ideal for transceivers and limited space applications. All crystals fully guaranteed. The following listed frequencies shipped immediately.

Quantity available				Frequency in Mcs.		
16.000	16.250	16.500	16.750	17.000	17.250	17.500
17.750	18.000	18.250	27.000	27.250	27.500	28.500
28.750	29.000	29.260	29.500	29.750	30.000	32.75
33.000	36.050	36.100	36.150	36.200	36.250	36.300
36.350	36.400	36.450	36.500	48.050	48.383	48.716
49.050	49.383	49.716	50.050	51.050	51.383	51.716
52.050	52.383	53.0075	53.050	53.383	53.2575	53.3075
53.7075	53.716	53.7575	53.8075	53.8575	53.9075	53.9575
55.050	55.383	64.992	65.992	66.992	67.992	68.992
69.992	70.992	71.992	72.992	73.000	75.000	78.000
79.000	80.000	81.000	82.000	83.000	84.000	85.000
86.000	87.000	88.000	89.000	90.000	96.000	97.000
98.000	99.000	100.000	101.000	102.000	102.86	103.06
103.26	103.26	103.46	103.66	103.86	104.06	104.26
104.46	104.66	107.000	111.000			

Limited quantity.

25.750	25.250	32.500	33.250	50.716	61.050	74.000
103.000						

SAME CRYSTALS AS ABOVE. SAME PRICE. THIS LIST OF CRYSTALS IS AVAILABLE. HOWEVER I CANNOT SHIP UNTIL 10 DAYS AFTER RECEIVING YOUR ORDER. LISTING MAY NOT BE IN ORDER SO DISREGARD SEQUENCE.

Available in Quantity				Frequency in Mcs.		
14.000	14.050	14.100	14.150	14.200	14.250	14.300
14.350	14.400	14.450	14.500	14.550	14.600	14.650
14.700	14.750	14.800	14.850	14.900	14.950	16.950
17.000	17.350	17.450	17.550	17.650	17.800	17.850
23.500	23.750	24.000	24.250	24.500	24.750	26.250
26.500	26.750	27.750	28.000	28.250	30.250	30.500
30.750	31.000	31.250	31.500	31.750	33.100	33.200
33.300	33.400	33.500	33.600	33.700	33.800	33.900
36.550	36.600	36.650	36.700	36.750	36.800	36.850
36.900	36.950	41.000	41.050	41.100	41.150	41.250
41.200	41.300	41.350	41.400	41.450	41.500	41.550
41.600	41.650	41.700	41.750	41.800	41.850	41.900
41.950	42.050	42.150	42.250	42.450	42.550	42.650
42.750	42.850	42.950	42.400	44.740	45.50	46.240
46.400	53.0575	53.1075	53.1575	53.2075	53.3575	53.4075
53.4575	53.5075	53.5575	53.6075	53.6575	54.050	54.383
54.716	55.716	56.050	57.716	60.050	73.992	74.992
75.992	76.992	77.992	78.992	79.992	80.992	81.992
82.992	83.992					

JUST ARRIVED — CRYSTALS IN FT-243 TYPE HOLDERS. — CRYSTALS SELL AT $1.05 each postpaid USA. Frequency Tol. .05%. All crystals fully guaranteed. Quantity available.

1900	1905	1910	1915	1920	1925	1930	1935	1940	1945
1950	1955	1960	1965	1970	1975	1980	1985	1990	1995
2000	2005	2010	2015	2020	2025	2030	2035	2040	2045
2050	2055	2060	2065	2070	2075	2080	2085	2090	2095
2100	2105	2110	2115	2120	2125	2130	2135	2140	2145
2150	2155	2160	2165	2170	2175	2180	2185	2190	2195
2200	2205	2210	2215	2220	2225	2230	2235	2240	2245
2250	2255	2260	2265	2270	2275	2280	2285	2290	2295
2300	2305	2310	2315	2320	2325	2330	2335	2340	2345
2350	2355	2360	2365	2370	2375	2380	2385	2390	2395
2400	2405	2410	2415	2420	2425	2430	2435	2440	2445
2450	2455	2460	2465	2470	2475	2480	2485	2490	2495
2500	2505	2510	2515	2520	2525	2530	2535	2540	2545
2550	2555	2560	2565	2570	2575	2580	2585	2590	2595
2600	2605	2610	2615	2620	2625	2630	2635	2640	2645
2650	2655	2660	2665	2670	2675	2680	2685	2690	2695
2700	2705	2710	2715	2720	2725	2730	2735	2740	2745
2750	2755	2760	2765	2770	2775	2780	2785	2790	2795
2800	2805	2810	2815	2820	2825	2830	2835	2840	2845
2850	2855	2860	2865	2870	2875	2880	2885	2890	2895
2900	2905	2910	2915	2920	2925	2930	2935	2940	2950
2955	2960	2965	2970	2975	2980	2985	2990	2995	2945
3000	3005	3010	3015	3020	3025	3030	3035	3040	3045
3050	3055	3060	3065	3070	3075	3080	3085	3090	3095
3100	3105	3110	3115	3120	3125	3130	3135	3140	3145
3150	3155	3160	3165	3170	3175	3180	3185	3190	3195
3200	3205	3210	3215	3220	3225	3230	3235	3240	3245

THE ABOVE LISTED CRYSTAL FREQUENCIES ARE IN KILOCYCLES

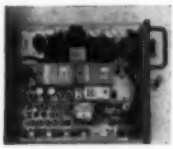
LOW FREQUENCY CRYSTALS IN FT-243 TYPE HOLDERS. Crystals sell at $1.05 each postpaid USA. All crystals fully guaranteed.

Limited quantity available. Freq. in Kcs. Give 2nd choice select

1005	1010	1020	1055	1070	1090	1170	1200	1235	1240
1265	1270	1310	1375	1400	1405	1420	1610	1100	1115
1125	1130	1300	1350	1355	1380	1440	1730	1765	1780
3270	3400	3430	3440						

CRYSTAL OVEN — LARGE SIZE — PLUGS INTO 5-PIN TUBE SOCKET. ACCEPTS 1" x 1" TYPE BLANKS. FREQUENCY CAN BE ADJUSTED BY TURNING PRESSURE TYPE ADJUSTMENT SCREW. CAN BE TAKEN APART SO NEW BLANKS CAN BE USED. HEATER VOLTAGE 6.3 V. THERMOSTATICALLY CONTROLLED. IDEAL FOR EXPERIMENTING AND ECT. ONLY $1.50 each postpaid USA.

FM FM FM FM FM

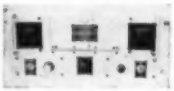


T44A-6

MOTOROLA T44A SERIES 450MC TRANSCEIVER. 6/12 V. D.C. power supply. Transmitter—18W output crystal controlled, 2C39 final. 2C39 driver.

Receiver-crystal controlled triple superhet 0.8 uv sensitivity, IF frequencies are 72MC, 8MC, and 455KC. Schematic and conversion information available in Digest listed below.

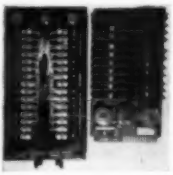
T44A-6 **$54.50**
Case for above **$ 2.50**
Control Head w/microphone **$ 5.95**



TT-63A

RTTY-AN/TT-63A REPEATER SET

Capable of receiving teletype-writer signals in audio or direct current form having up to 45% distortion and regenerating the signal to have less than 5% distortion. Schematics furnished. See April 1964 RTTY for further details. **$34.95**
SFO-2 Same as above — used **$30.00**



Scantlin 1315

TELEPHONE SELECTORS
SCANTLIN MODEL 1315 SELECTOR

This unit is a device used in radio telephone and other applications to enable selective calling of one station from a group of stations. It is completely compatable with existing Bell System telephone installations. The selector performs the function of translating a series of 1500 and 600 cycle coded audio frequency signals into a switching action which operates a sound transducer and call light. **$32.50**

TU 154

TU 277

MOTOROLA 60W MOBILE POWER SUPPLIES 6/12V INPUT

TU 154 dual vibrator power supply 200V Rec. power supply 700v transmit power supply. Schematic furnished **$17.50**
TU 277 dual input dynamotor vibrator Rec. power supply dyn. 650V/370 MA. Schematic furnished **$14.50**

BOOKS

WIDE BAND FM FOR THE AMATEUR by Aagaard and Dubois. Covers specific conversion of Motorola gear to 2 meters. 47 pages. Price **$1.75** postpaid

MOTOROLA FM EQUIPMENT SCHEMATIC DIGEST. Contains a comprehensive collection of Motorola transmitters, receivers, power supply, and inter-connecting diagrams for Motorola FM equipment manufactured between 1949 and 1954. Covered is a 30-50 MC, 150-170MC and 450 MC equipment. Crystal formulas, crystal correlation data and basic alignment instructions are given. A test set diagram is given for metering all Motorola gear. Typical readings for many transmitters are tabulated. A brief description is given for each generic type of Motorola chassis. Specific crystal data and complete alignment and 432MC conversion instructions are given for Motorola T44A Series 450MC equipment. 90 Pages
Price $3.95 P.P.

FM equipment is offered to licensed radio amateurs. Quantities are limited to two items to a customer. Each unit unless otherwise noted is a complete receiver, transmitter and power supply, a tube or two may be missing. Cases, cables, microphones, control heads, and crystals are not available. Equipment is offered "as-is." All items subject to prior sale — Terms: Payment with order — shipping: FOB Boston — Specify Carrier — Prices subject to change without notice. We sell Motorola equipment only. All equipment is used and subject to prior sale.

FM SURPLUS SALES CO., 1100 TREMONT ST., BOSTON 20, MASS.

TEL. 617, 417-3511

PRIMARY FREQUENCY STANDARDS

Atomichron

NATIONAL ATOMICHRON

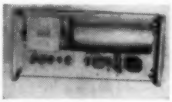
The Model NAFS-1 Atomichron is a general purpose cesium beam, primary frequency standard. Units have been in use for many years as calibration devices in various government and civilian laboratories, and also as the prime frequency generator in military and industrial communication, timing, tracking, and control systems. Measurements made by the Naval Observatory on several NC 1001 Atomichrons over many years indicate a maximum disagreement of 2 pp 10^{10}.

LONG TERM STABILITY: 5 PARTS IN 10^{10} FOREVER!

SPECIFICATIONS NAFS-1

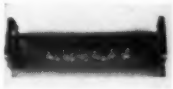
1. Accuracy ..... +5 pp 10^{10}
2. Reproducibility ..... 5 pp 10^{10}
3. Long term stability ..... 5 pp 10^{10}
4. Short term stability ..... +1 pp 10^{10}RMS
5. Warm up time . . . 1 hr. (for full specifications)
6. Output frequencies and levels . . . 0.1 mc, 5.0 mc, 10.0 mc and 100.0 mc
   Note: All outputs deliver 1 volt across a 50 Ohm load and are simultaneously available on front panel.
7. Fail Safe . . Automatic warning circuits provide visual indication of proper operation
8. Size . . . 22" wide, 18" deep, 84" high
9. Weight . . . 700 lbs. (uncrated)
10. Power Requirement . . . 105, 115, 125V +10% at 60 cps +15%
    Power Consumption is 900 watts

F.O.B. Boston **$1750.00**



40K-1

COLLINS 40K-1 HIGH STABILITY FREQUENCY STANDARD. 1 MC output stable to 1 part in 10^8 per day. Crystal in proportional oven within Dewar flask. Requires 426A-1 power supply. **$225.00**



8U-1

COLLINS 8U-1 DIVIDER. Gives output of 1 MC, 100KC, and 10KC by the use of regenerative dividers. Used with 40K1 **$75.00**

426-A-1

COLLINS 426-A-1 POWER SUPPLY for 2, 40K-1 oscillators or 1, 40K-1 and 1, 8U-1 divider **$75.00**

COLLINS 54M-1 FREQUENCY COMPARATOR. Samples any 2 of 3 1 MC signals. Frequency or phase difference shown on front panel meter. Requires external power supply. **$99.00**

Above equipment fully calibrated and standardized against WWVB.

Send for data on these Collins units.

FM SURPLUS SALES CO., 1100 TREMONT ST., BOSTON 20, MASS.

TEL. 617, 417-3511

ELECTRONIC SURPLUS BARGAINS
SAVE UP TO 90%

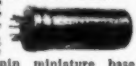
BLACKLITE KIT FOR ULTRA-VIOLET FLUORESCENCE

For qualitative work in laboratory or shop for mineral identification and display. The long-wave ultra-violet light produced by the 4-watt or 8-watt lamps is in a range of from 3500 to 3660 A. The tubes contain a high-emission phosphor in the above range. Lamps are of the blue-glass type for filtering out most visible light. KIT CONTAINS: Ultra-violet tube, brackets, ballast, starter, wire, plug, and wiring diagram. (110-VAC operation, long-wave).
4-WATT KIT (5¼" tube) . . . $3.50 Kit
8-WATT KIT (12" tube) . . . $4.50 Ppd.

NT-6 WILLARD 6-VOLT STORAGE BATTERY

Rated 2.4 amp. hr. Approx. dimensions: 3½" l. x 1⅞" w. x 2¾" h. Weight: 1 lb. 3 oz. (plastic case) Dry-charged.
$2.50

POTTER & BRUMFIELD RELAY



#8M5LS 8PDT 8,000 ohm 11/16" dia. x 1 11/16" long. Approx. weight 1 oz. Hermetically sealed. Standard 7-pin miniature base.
$2.00

MINOR SWITCH

10-position, 3-pole with stopper coil and reset coil 6-12 volts D.C. off-normal non-bridging wiper approx. dimensions: 4" long x 4½", high x 1⅝" wide. weight: 1 lb.
$9.95

RT-82/APX6 TRANSPONDER

Good used condition less tubes. . . . $9.95

OIL CAPACITORS

1 mfd. 25,000 V. DC Westinghouse Interteen Type FP Style 1313854.
$39.95 each

10 or more, $35.00 each.

GENERAL ELECTRIC FULL WAVE BRIDGE GERMANIUM RECTIFIER

Input 117 volt AC, output 115 volt DC at 10 amperes approximate dimensions: 4⅞" x 4⅜" x 7½" long weight: 3½ lbs.
PRICE . . . . . $9.95 each

TEST SCOPE—SYNCHROSCOPE—PULSE ANALYZER

ID-59/APA-11. Late production. Modular subassembly construction. Video amplifier is flat to 4 mc. 3BP1 presentation. Test-scope sawtooth 25-20,000 cy. Has all normal test-scope controls. As synchroscope and pulse analyzer, accepts positive or negative pulses. Video delay circuit permits leading edge of pulse to be seen. Calibrated-dial horizontal shift measures pulse durations from 0.5 to 100 microseconds. Sinewave-oscillator calibrator measures recurrence rates from 200 to 6000 pps accurate within 0.4%. Built-in power supply requires 115v, 400 cy, 196 watts. External 60 cy power supply may be made to furnish plus 350 and—1300 vdc and 6.3 vac. In excellent condition, with all 19 tubes, schematic with parts values, parts-location pictures, operating instructions, theory explanation, and maintenance charts. Shipping weight 60 lbs. Used, good. Price each $19.50

ANTENNA WIRE

150 ft. stranded copper
PRICE . . . . . $2.95 ea.

RG 58A COAX CABLE

52 OHM, 100 ft. lengths $3.95

NICKEL CADIUM BATTERY 1.2 VOLTS

Rechargeable thousands of times. Alkaline storage battery sintered-plate. Flat voltage curve during discharge. Will hold charge for long period of time. High discharge rate up to 50 amps. Still-proof, may be used in any position. Approx. 6-ampere-hour capacity. Dimensions: 6" high; 2" wide; ⅛" thick. Approx. wt. 6 oz. Uses potassium hydroxide (30% Electrolite).

8-DAY AIRCRAFT CLOCK

24-hr. dial and civil date indicator. Center sweep second hand, luminous figures and hands on black face. Case is made of black plastic 3⅛" mounting. Manufactured by Waltham Watch Co.
$20.95 Postpaid

2⅝"x4¼". Wt. 3¼ pounds.
POWER TRANSFORMER
Output: 12, 24, 36 volts. Input: 100 volts, 60 cycles, single-phase. Will handle 2½ amps. Steel case is hermetically sealed, 3½"x
$2.95

DIRECT-READING MAGNETIC COMPASS

Full-floating card, compensating magnets, and dial light avail. in 6- or 12-v. bulb. Luminous dial. Mfd. by Bendix-Pioneer. 3¾" x 3¼" x 3½". 1¾ lbs.
$8.50 postpaid.

TCS DYNAMOTORS

12 volt D.C. input, 9.9 amps; output 440 volt D.C. at 200 ma new $7.95

12 volt D.C. input, 3.6 amps; output 225 volt D.C. at 100 ma new . . . . . $2.95 each

RADIO COMPASS RECEIVER

B5/ARN7 Frequency 100 to 1750 KC
Price $17.50
R5A/ARN7 Price $27.50
Loop LP21 LM Price $12.50
Control Box C4/ARN7 Price . . . . . $ 7.50
Indicator 181A Price . . . . . $ 4.95

VARIAC TYPE V20

input 120 volt AC 50/60 cycles output range 0-140 volts, 20 amperes.
PRICE . . . . . $37.50 each

TYPE AN/ARN-6 RADIO COMPASS

Receiver R/101/ARNN-6, 100-1750 kc. in 4 bands. Excellent condition.
Price $34.50
Loop AS13-B. Excellent Condition. Price $27.50
Indicator ID91B/ARN-6 Excellent Condition.
Price . . . . . $ 9.95
Mounts MT-273 or MT-274 Excellent Condition. Price Ea. . . . . $ 9.95
Control Box C-149A. Price $15.00

MANUAL

Handbook of operating instructions, general installation adjustment plus 5 pages of diagrams and Schematics. Price $ 3.50

250-WATT SOLDERING IRON

Mfg. VASCO, 110-volt AC, 60-cycle, single-phase. U.L.-approved. Brand new $9.95 including stand.

12 FT. TELEPHONE STRETCH CORD

3 conductor wire with JK-53 and a U31/GT plug.
PRICE . . . . . $1.49 ea.

SILICON RECTIFIERS

All rectifiers listed at maximum peak inverse voltage ratings; approximate forward voltage drop. 1.5 volts.

1N1446	.075	amp.	100 volts	.50
1N1447	.075	amp.	200 volts	.60
1N1448	.075	amp.	300 volts	.75
1N1449	.075	amp.	400 volts	.85
1N1450	5	amp.	100 volts	1.00
1N1451	5	amp.	200 volts	1.25
1N1452	5	amp.	200 volts	1.50
1N1453	5	amp.	400 volts	2.00
1N1454	25	amp.	100 volts	3.00
1N1455	25	amp.	200 volts	3.50
1N1456	25	amp.	300 volts	4.50
1N1458	35	amp.	100 volts	3.50
1N1459	35	amp.	200 volts	4.00
1N05P7	50	amp.	50 volts	6.00
1N1462	50	amp.	100 volts	7.00
1N1466	75	amp.	100 volts	10.00
1N1467	75	amp.	300 volts	11.00
1N1468	75	amp.	300 volts	12.50
1N05V7	150	amp.	50 volts	16.50
1N1474	150	amp.	100 volts	17.00

X-BAND POWER LEVEL TEST SET, TS-36/AP

Brand new, in original packing, has accessories. Measures 10 to 30 dbm. 8700-9500 mc.
$14.95

RT-82/APX-6 TRANSCEIVER

Easy to convert to 1215 Mc Ham Station. Good Condition, Less Tubes $9.95

WATTHOUR METER

Manufactured by General Electric Company. Operates on 110 volts, 60 cycle, 10 amps, single phase, reads 4 digits. Ideal for the shop, apartments, trailers, etc. Price: $2.95 each F.O.B. Pasadena, California.

U. S. NAVY 145-DAY TIMER

This unit was used by the Navy to activate and de-activate mines at sea. Has a setting from 1 to 145 days.
Unit contains a 12 volt D.C. permanent magnet motor, precision clock movement, switches, approximately 30 brass precision gears; enclosed in a metal case with inspection window. Approximate dimensions: 3¾" dia., 4" long. Unused condition.
Cost Government hundreds of dollars. Our price: $3.95 each, postpaid.

POWERSTAT TYPE 20

input 120 volt AC, 50/60 cycle output range 0-140 volts AC, 2 amperes.

POWERSTAT TYPE 116

input 120 volts, 50/60 cycle output range 0-140 volts AC, 7.5 amperes.
PRICE . . . . . $16.95 each

COAX CABLE RG59A/U

50 ft. roll complete with coax fittings.
PRICE . . . . . $2.49 ea.

All prices FOB Pasadena unless otherwise noted. No COD's.

C & H SALES CO.
2176 E. Colorado St., Pasadena, Calif.
MUrray 1-7393

OFF-SHELF AVAILABILITY ON THESE SEMICONDUCTORS

PER EACH		ADD 50% ON SINGLE LOT		
TYPE	MFGR	10	100	1000
1N34	Clev	.19	.08	.06
1N34A	Pac	.21	.14	.12
1N5	CBS	.72	.48	---
1N58A	Amp	.36	.24	.22
1N9	Clev	.98	.65	---
1N3	Clev	.15	.10	.08
1N4	Clev	.18	.12	.09
1N5	Clev	.18	.12	.09
1N9	Clev	.14	.09	.07
1N1	CBS	.18	.12	---
1N2	CBS	.23	.15	---
1N3	Syl	.27	.17	---
1N5	CBS	.27	.18	.15
1N58AG	CBS	.27	.18	.15
1N58A	Amp	.30	.20	.16
1N58A	CBS	.27	.18	.15
1N60	SPI	.19	.09	.07
1N64	Ray	.19	.09	.07
1N64G	CBS	.17	.07	.05
1N65	SPI	.23	.15	.12
1N67	Ray	.24	.16	.14
1N67A	Hugh	.30	.20	.18
1N68	Hugh	.30	.20	.18
1N69A	Tran	.23	.15	---
1N72A	Syl	.75	.39	.33
1N73	Amp	.33	.22	.18
1N74	Syl	.27	.18	.15
1N74G	Amp	.26	.17	.14
1N78	Amp	.33	.22	.18
1N81	G.E.	1.00	.50	---
1N82	G.E.	1.40	.95	---
1N86	CBS	.24	.14	.14
1N88	Clev	.26	.14	.12
1N89	CBS	.21	.14	.12

TYPE	MFGR	10	100	1000
1N100	SPI	.24	.16	.14
1N108	SPI	.38	.25	.21
1N116	Hugh	.21	.14	.12
1N118	Clev	.18	.12	.09
1N119	SPI	.44	.29	.26
1N128	Ray	.14	.09	.07
1N142	Amp	.68	.45	---
1N144	Tran	.60	.40	---
1N153	G.E.	2.95	1.95	---
1N191	Clev	.18	.12	---
1N198	Clev	.17	.11	.09

TYPE	MFGR	10	100	1000
1N307	Ray	1.50	1.00	---
1N308	SPI	.39	.26	.21
1N309	SPI	.33	.22	.18
1N310	Clev	.24	.16	.14
1N312	Clev	.21	.14	.12
1N338	Tran	1.65	.95	---
1N342	Tran	1.28	.85	---
1N344	Tran	1.43	.95	---
1N368	G.E.	1.65	.95	---
1N429	Tran	.89	.59	.39
1N438	Ray	.59	.39	---

TYPE	MFGR	10	100	1000
1N541	CBS	.20	.13	.11
1N542	Clev	.26	.17	.14
1N547	T-S	.90	.60	.55
1N627	Pac	.50	.33	---
1N631	CBS	.33	.22	.18
1N634	Clev	.39	.26	.22
1N636	CBS	.14	.09	.07
1N658	Clev	.30	.20	---
1N661	Clev	.35	.23	---
1N663	Pac	.54	.35	---
1N677	Tran	.24	.16	---
1N678	Clev	.29	.19	.16
1N681	Clev	.36	.24	.20
1N770	CBS	.24	.16	.12
1N775	CBS	.44	.29	---
1N789	SPI	.48	.32	.26
1N903	F'ch	2.93	1.95	---
1N914	Tran	2.25	1.50	---
1N1354	Hoff	2.48	1.65	---
1N1368	Hoff	2.48	1.65	---
1N1514	NAE	1.13	.75	---
1N1517	IR	2.93	1.95	---
1N1526	IR	1.13	.75	---
1N2069	Tran	.35	.26	.20
1N2070	G.I.	.45	.30	.22
1N2071	G.I.	.60	.40	.24
1N2492C	Tran	2.55	1.70	---
1N2494C	Tran	4.13	2.75	---
CK-707	Ray	.12	.08	.04
CK-772	Ray	.14	.09	.06
CK-841	Ray	.36	.24	.19
CK-842	Ray	.42	.28	.22
FD-600	F'ch	4.95	3.75	---
PS-770	Pac	.14	.09	.07
SV-815	Tran	.98	.65	---
SV-1055	Tran	1.43	.95	---
TM-17	Tran	1.00	.65	---

QUANTITY LIMITED DIODES SHIPPED PREPAID

TYPE	MFGR	10	100	1000
1N216A	Tran	1.20	.80	---
1N231	Clev	3.68	2.45	---
1N249	Tran	2.50	1.65	---
1N251	Syl	.45	.30	.18
1N251	Tran	.30	.15	.09
1N270	SPI	.45	.30	.26
1N273	CBS	.21	.14	---
1N276	Tran	.23	.15	---
1N277	SPI	.45	.30	.25
1N278	CBS	.38	.25	---
1N279	Clev	.18	.12	.09
1N281	Ray	.18	.12	---
1N281G	CBS	.14	.09	.07
1N283	CBS	.23	.15	---
1N287	CBS	.23	.15	---
1N290	Clev	.23	.15	---
1N291	Clev	.23	.15	---
1N292	Clev	.21	.14	.10
1N294	Ray	.18	.12	.09
1N295	SPI	.19	.09	.07
1N297	CBS	.30	.20	.16
1N298	CBS	.18	.12	.09
1N301A	Ray	2.33	1.55	---

TYPE	MFGR	10	100	1000
1N441	Amp	.29	.19	---
1N442	Amp	.35	.23	---
1N447	CBS	.18	.12	.09
1N448	Clev	.26	.17	.13
1N449	Clev	.24	.16	.12
1N450	Clev	.26	.17	.13
1N452	CBS	.24	.16	.12
1N453	Clev	.26	.17	.13
1N454	CBS	.24	.16	.12
1N457	T.I.	.29	.19	---
1N458	Ian	.45	.30	---
1N459	Tran	.32	.21	.18
1N461	Clev	.24	.16	.12
1N462	Clev	.26	.17	.13
1N463A	CBS	.30	.20	.14
1N497	CBS	.24	.16	.13
1N498	SPI	.29	.19	.16
1N499	CBS	.26	.17	.14
1N500G	CBS	.26	.17	.14
1N537	Ray	.24	.16	---
1N538(CK841)	Ray	.29	.19	---
1N539(CK842)	Ray	.33	.22	---
1N540	Ray	.54	.36	.28

TYPE	MFGR	EACH	10	100
2N34	Syl	2.93	1.95	---
2N35	Syl	1.15	.75	---
2N43	T-S	.60	.40	.33
2N44	T-S	.53	.35	.28
2N45	T-S	.45	.30	.23
2N94A	Syl	1.10	.85	---
2N117	T.I.	5.93	3.95	2.95
2N118	T.I.	5.93	3.95	---
2N123	G.E.	2.18	1.45	1.15
2N144(1603)		4.28	2.85	1.95
2N155	CBS	.89	.59	.39
2N174	T-S	2.84	1.89	1.69
2N174A	T-S	2.99	1.99	1.73
2N194	Syl	1.10	.85	---
2N212	Syl	1.25	1.00	---
2N213	Syl	1.10	.85	---
2N214	Syl	1.20	.90	---
2N228	Syl	1.35	.95	---
2N229	Syl	.45	.32	---
2N233A	Syl	.89	.78	---
2N235	Tran	1.04	.69	.49
2N236	Tran	1.04	.69	.49
2N242	T-S	1.34	.89	---
2N248	T.I.	1.43	.98	.85
2N255A	CBS	.89	.59	.39
2N256	CBS	1.04	.69	.49
2N257	CBS	1.04	.69	.49

TYPE	MFGR	EACH	10	100
2N270	RCA	.80	.45	---
2N277	T-S	1.49	.99	---
2N301A	T-S	1.49	.99	.79
2N306	Syl	.79	.65	---
2N307	T-S	1.04	.69	.49
2N307A	T-S	1.19	.79	.59

GUARANTEED TRANSISTORS MINIMUM $5.00

TYPE	MFGR	EACH	10	100
2N326JAN	Syl	5.85	4.50	3.50
2N335	Tran	2.78	1.85	1.35
2N337	G.E.	3.85	---	---
2N338	T.I.	4.13	2.75	---
2N341	T.I.	11.93	7.95	6.50
2N378	T-S	1.49	.99	.79
2N379	T-S	1.79	1.19	.95
2N380	T-S	1.64	1.09	.89
2N384	RCA	1.58	1.05	.95
2N385	Syl	1.50	1.00	.90
2N389	Tran	27.00	18.00	12.00
2N396A	G.E.	.62	.45	.41
2N398A	RCA	1.10	.88	---
2N404	UST	.50	.41	.32
2N440A	Syl	2.33	1.55	1.35
2N441	T-S	1.15	.85	---
2N442	T-S	1.85	.95	---
2N443	T-S	2.09	1.39	1.05

TYPE	MFGR	EACH	10	100
2N459	T-S	2.03	1.35	.95
2N464	Ray	1.43	.95	---
2N497	Rh	1.80	1.35	1.00
2N498	Rh	1.80	1.35	1.00
2N501	Phil	5.78	3.85	3.45
2N504	Phil	2.93	1.95	1.50
2N600	Phil	3.38	2.25	1.95
2N656	Tran	4.43	2.95	---
2N656	Rh	1.80	1.35	1.00
2N657	Rh	1.80	1.35	1.00
2N696	Rh	1.10	.85	.60
2N697	Rh	1.55	1.10	.85
2N699	Rh	1.80	1.35	1.00
2N706	F'ch	2.33	1.55	1.25
2N711	T.I.	1.13	.75	.65
2N711A	T.I.	1.28	.85	---
2N769	Phil	4.43	2.95	---
2N781	Syl	7.50	5.00	3.95
2N797	T.I.	4.00	2.85	2.65
2N869	F'ch	9.00	6.95	5.50
2N930	T.I.	8.00	6.00	5.00
2N1021	T-S	2.03	1.35	.95
2N1040	T.I.	5.00	3.95	---
2N1049	T.I.	13.43	8.95	---

TYPE	MFGR	EACH	10	100
2N1073	T-S	2.78	1.85	1.60
2N1073A	T-S	3.60	2.40	2.25
2N1073B	Bx	4.28	2.85	2.55
2N1100	T-S	3.89	2.59	1.99
2N1132	F'ch	6.50	4.75	---
2N1163	Mot	4.28	2.85	2.70
2N1204	Mot	5.93	3.95	3.45
2N1225	RCA	1.28	.85	.75
2N1251	Syl	.98	.65	.55
2N1252	Rh	1.80	1.35	1.00
2N1253	Rh	3.15	2.20	1.75
2N1302	Amp	.50	.33	.30
2N1304	Amp	.60	.45	---
2N1358	T-S	3.59	2.39	1.79
2N1372	T.I.	.74	.49	.43
2N1375	T.I.	1.20	.80	.70
2N1376	T.I.	1.13	.75	.65
2N1412	T-S	5.18	3.15	2.95
2N1613	Rh	1.80	1.35	1.00
2N1613	F'ch	2.00	1.65	1.40
2N1837	Pac	10.43	6.95	4.95
2N1922	Sper	9.75	6.50	4.65
2N2076	T-S	3.29	2.19	1.89
2N2490	T-S	2.99	1.99	1.69
2N2492	T-S	2.93	1.95	---
GT-792	Gen	1.35	.90	.65
904A	T.I.	2.40	1.65	.95

750 MA EPOXY RECTIFIERS

PIV	EACH	10 PAC	100 BULK
200	.34	.24	.17
400	.46	.32	.23
600	.56	.38	.28
1000	.79	.55	.48

750 MA "TK" RECTIFIERS

PIV	EACH	10 PAC	100 BULK
200	.36	.25	.18
400	.48	.34	.24
600	.58	.40	.29
1000	.89	.60	.49

750 MA TOP HAT RECTIFIER

PIV	EACH	10 PAC	100 BULK
200	.38	.27	.19
400	.54	.38	.25
600	.64	.44	.30
1000	.99	.69	.59

750 MA SILICON RECTIFIERS

AUDIO DEVICES — LESS HOLDER

TYPE	PIV	EACH	10	100
1N1446	100V	.27	.19	.17
1N1447	200V	.37	.29	.25
1N1448	300V	.45	.36	.29
A-250	250V	.41	.32	.27

SILICON POWER RECTIFIERS

PIV	2 AMPERE EACH	2 AMPERE 10	12 AMPERE EACH	12 AMPERE 10	25 AMPERE EACH	25 AMPERE 10	70 AMPERE EACH	70 AMPERE 10	125 AMPERE EACH	125 AMPERE 10
50	.17	.14	.75	.53	1.50	1.15	3.95	2.85	5.95	3.95
100	.30	.22	1.20	.85	2.50	1.75	4.85	3.49	6.49	4.65
200	.45	.32	1.75	1.25	3.70	2.59	5.95	4.35	7.95	5.65
400	.89	.63	2.60	1.89	4.75	3.49	6.95	5.25	9.95	7.95
600	1.35	.96	3.95	2.95	6.95	5.25	9.95	7.95	***	***
1000	2.49	1.79	7.95	5.65	***	***	***	***	***	***

INSULATED STUD MOUNTED TYPES

CERAMIC BASE

PIV	2 AMPERE EACH	2 AMPERE 10	12 AMPERE EACH	12 AMPERE 10
50	.24	.19	.89	.69
100	.39	.29	1.40	.99
200	.65	.47	1.95	1.45
400	1.29	.95	2.95	2.25
600	1.69	1.25	4.25	3.40
1000	***	***	***	***

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R19/ARC12—118 to 148 mc Tunable Receiver complete with 9 tubes and schematic. **$29.95**

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2500—Cavity tuner for 1B40, 1B43 and 1B37. New, less tubes. **$3.95**
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2000-1500-0-1500-2000 volts. ½ amp. **$40.00**
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530-0-530 volts. 420 ma. **$6.95**
400-0-400 volts. 175 ma; 12 v - 3 A; 5 v - 3 A. **$3.95**
400-0-400 volts. 100 ma **$1.95**
370-0-370 volts. 165 ma; 6 v - 4.5 A; 5 v - 3.5 A. **$3.95**
2100 volt. 10 ma. Scope. **$1.95**
2300 volt. 4 ma; 2½ v fil. **$2.95**
10 v. 5 amp. **$1.95**

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8 Henry. 500 ma. **$6.95**
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12 H. 150 ma. **$1.95**
7 H. 70 ma. **$.69**
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10 H. 720 ma. 12000 v. **$22.50**

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100 mfd. 4000 vdc. Oil filled. **$49.50**
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8 mfd. 1000 vdc. **$2.50**
4 mfd. 4000 vdc. **$8.95**
4 mfd. 3000 vdc. **$5.95**
3 mfd. 2500 vdc. **$2.95**
2 mfd. 4000 vdc. **$4.95**
2 mfd. 3000 vdc. **$2.95**
10 mfd. 600 vdc. **$1.29**
8 mfd. 600 vdc. **$.98**
2 mfd. 600 vdc. **$.49**

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Diodes—assorted—all new. **10 for $1.50**

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GH-1203-2H. Lionel transformer. **$.98**
1193 Relay test set. **$19.95**
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2830 kc if transformers. **$.69**
1415 kc if transformers. **$.69**
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Each board contains at least 20 transistors that have leads ½ to 1 in. long for easy removal and reuse, plus the usual run of resistors, capacitors, diodes, etc. An experimenters delight. **$2.95 each.**

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Plugs—racks—mounts—control boxes and many other accessories also available.

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2C40	5.00	**723AB**	5 00	**5692**	1.00
2C43	4.00	**807**	1.00	**5763**	1.00
2E26	2 00	**808**	1.00	**5842**	5.00
3B24	1.00	**813**	9.00	**5894**	12.00
5R4GY	1.00	**815**	2.50	**6146**	2.00
6L6G	1.00	**832A**	4.00	**8012**	1.00
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HS33	Headset. 600 ohms. New.	6.95
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CD307	Ext. cord. New.	.95
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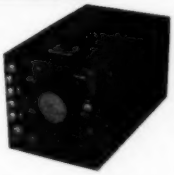

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It is small (only 8.75" x 9" x 16") and light (only 22.5 lbs.). Ask for and get with your order the **original** schematic with parts values and Circuit explanations, **plus** a conversion instruction and **converted** schematic with parts values. Excel. Cond. With all tubes. Shpg wt 30 lbs.
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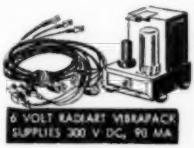
1.25 v-20 amp hour capacity. **$3.75 per cell.**

ARC1—Transceiver. 100 to 156 mc complete with tubes. 50#. **$24.95**



Radiart 6821A (RCA MI-8391A) used to mobilize AR-77 & AR-88 rcvrs. Input 6 to 8.5v dc as selected by a 4-position switch to xfrmr taps. The vibrator is Mallory 634C or Radiart VN-10 or any 4-pin non-synch replacement. At full load, the pack draws 12 amps. A 15A fuse is in the battery cord furnished. An OZ4 tube rectifies. Output is filtered. New, with instruction book, schematic, & parts list. Shpg wt 12 lbs. Cat. No. 806VP1. Only **$2.95 each 4 for $10**

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0-20	Microamps DC	3½" Rd.	5.95
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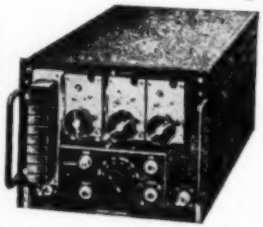
Transceiver ARC-1



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SORENSON # 600 BB 600 VDC 500 Ma., 6.3 VAC 10 A. **$195.00**
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OREGON D4R Dual 300 VDC, 200 Ma. (provision for series or parallel connect on front panel + 150V bias + 400 VDC, 200 Ma. unreg.+ 2x 6.3VAC 5A.) **$150.00**
DRESSEN BARNES 3-500B. Dual 0-300 VDC 500 Ma.+ dual 6.3VAC 10A **$250.00**

ALL MERCHANDISE FULLY GUARANTEED. MANY, MANY MORE ITEMS IN STOCK. YOUR REQUEST ON A COMPANY LETTER HEAD WILL PUT YOU ON OUR TEST EQUIPMENT MAILING LIST.
WE SHALL BE HAPPY TO CONSIDER THE PURCHASE OF ANY GOVT EQUIPT OR LAB TEST EQUIPMENT YOU HAVE FOR SALE. PLEASE INDICATE PRICE AND CONDITION AND WE SHALL REPLY BY RETURN MAIL. ALL THIS EQUIPMENT ON DISPLAY IN OUR STORE.

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(QST Dec. 1964)
Laminated core for 275 watts (stack two for 375 watts) **$1.95 ea.**

Variac core for 600 watts GR M-10 **$5.95 ea.**

88 MH Toroid Potted **5 for $1.00**

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Model 14 strip printer with keyboard less motor **$19.95 ea.**

Model 14 TD with synch motor, checked out, good working condition **$49.50 ea.**

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TYPING PAPER FOR MODEL 15, 10 rolls to a carton **$9.95 per carton.**

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MODEL 14 REPERF. WITH SYNCH MOTOR **$49.50**

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SELSYNS, 110 volts AC, like 5F, 5G etc. **$4.95 pair.**
Selsyns, small size, 2" diameter, 110 volts, 60 cycle **$3.95 pair.**

ARA 26 KEYER for keying transmitter, etc. **$3.95 ea.**

WALL PHONE with dial and hanger, ideal for extension telephone **$3.95 ea.**

TCS SPEAKER 5" diameter heavy duty Jensen, in steel cabinet, complete with controls, 600 ohms matching transformer **$4.95 ea.**

ARC-5 EQUIPMENT

2-3.1 MC Transmitter **$4.95 ea.**
3-4 MC Transmitter **7.95 ea.**
4-5.3 MC Transmitter **4.95 ea.**
5.3-7 MC Transmitter **4.95 ea.**
BC-456 modulator **3.95 ea.**
MD-7 modulator **6.95 ea.**
3-6 MC Receiver with automatic tuning head **9.95 ea.**
6-9 MC Receiver **9.95 ea.**
Command Receiver tuning knob **.75 ea.**
Single Receiver rack **1.49 ea.**

SPECIAL

APR-4 Tuning Units
TN-19—975 MC to 2200 MC **$49.50 ea.**
TN-54—2450 MC to 4000 MC **75.00 ea.**
STEREO PHONES MANUF. BY MONARCH **NEW $9.95**

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SCOOP WONDER TUBE
717 A direct replacement for 6SK7, 6SH7, 6SJ7, 6AK7, 6SG7, also used for octal 6AK5, good for reduction in noise level, and increase in IF gain, new **10 for $2.96**

1625 Tubes **4 for $1.00**

GB3B Victoreen Geiger tube **new $3.95 ea.**

811A, late date **$3.50 ea.**

5CP1 Scope Tube **$3.95 ea.**

SPECIAL
3C22 in new condition **$4.95 ea.**

ANY COMBINATION OF 10 of THE FOLLOWING TUBES FOR $1.96

5751 same as 12AX7
5814 same as 12AU7
5670 same as 2C51
6114 same as 12AU7
5998 same as 6AS7
707 B same as 1200 MC Klystron
6AC7
6H6
12BY7
6J6

3EP1 3" scope tube **$1.25 ea.**

3DP1 3" scope tube **2 for $1.00**

TEST EQUIPMENT

USM-24 Oscilloscope **$97.50 ea.**

TS-148 Spectrum Analyzer **$129.50 ea.**

TS-147 D **$225.00 ea.**

TS-186 Frequency Meter 100-10,000 MC **$149.50 ea.**

UPM-8 Signal Generator 980 to 1230 MC also used as pulse generator, Power Meter & receiver **$39.50 ea.**

TS-13 X band Signal Generator **$69.50 ea.**

TS-239 Oscilloscope 10 cycles to 5 MC **$87.50 ea.**

I-222 Signal Generator 8 to 15 MC and 45 to 77 MC **$39.50**

TS-345 Noise and Gate Generator **$22.50 ea.**

TS-102 Range Calibrator **$7.95 ea.**

TS-35 X Band Signal Generator **$39.50 ea.**

TS-45 X Band Test Set used for Wave Operation or external pulsing **$27.50 ea.**

TS-14 X Band Signal Generator **$39.50 ea.**

TS-61 SA Band Test Unit for pulse and frequency and power output **$22.50 ea.**

Binary Radiation Counter AC supply Laboratory type **$39.50 ea.**

TS-250 to test and calibrate radio altimeter **$12.50 ea.**

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2 METER EQUIPMENT

ARC-3 transmitter and receiver ..... **$19.95 ea.** or **$37.50 per set.**

ARC-4 transceiver ..... **$29.50 ea.**

ARC-5 transmitter, new condition ..... **$14.95 ea.**

ARC-1 transceiver 10 channel ..... **$29.50 ea.**
50 channel ..... **$39.50 ea.**

RA-62 AC power supply, designed for SCR-522 but can be adapted to work on any of the above units, **$29.50 ea.**

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Navy Receivers direct dial reading and fine tuning complete with power supply and tubes

RBA 15 KC to 600 KC ..... **$49.50 ea.**

RBB 600 KC to 4 MC ..... **49.50 ea.**

RBC 4 MC to 27 MC ..... **49.50 ea.**

RBS 2 MC to 20 MC ..... **49.50 ea.**

BC 1000 transceiver 18 tube portable 2 way range 40 to 48 MC can be used on 6 meters
less tubes .... **$29.50 ea.**
with tubes ... **$39.50 ea.**

Walkie Talkie Spare part kit
Consists of 24 crystals 5 antenna coils and 4 tank coils in wood carrying case ..... **$3.95 per kit**

Modulation Transformer, Collins 20 watts 200 to 5000 primary Z 6000 Secondery Z 6000 ..... **$.97 ea.** or **2 for $1.75**

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100 KC new in sealed metal case ..... **$4.95 ea.**

200 KC Metal sealed holder ..... **1.95 ea.**

9.050 Market crystal ..... **$1.95 ea.**

Low Frequency crystals ranging from 370 KC to 540 KC in 1.388 steps . **$.49 ea.** or **10 for $3.95**

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0-300 volts DC 2½" sealed ..... **$1.95 ea.**

0-800 volts DC 3" sealed ..... **$2.95 ea.**

3" basic 15 ma meter ..... **$1.95 ea.**

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2 volt, 26 amp hour ..... **$2.49 ea.**

1.2 Cadmium plate 4 amp hours ..... **$1.95 ea.**

Geiger Counter Light weight, complete with ear phone and batteries, new ..... **$4.95 ea.**

SCOOP

MOVIE SCREENS, 5 ft. by 4½ ft. **$1.95**

SCOOP, SCOOP

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RM 52 ..... **$1.49**

RM 53 cord and relay **$2.49**

24 volt generator 6 x 10" Output 28v at 24 amps. New **$7.95**

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TS 323/UR 20 to 450 mc **$175.00**

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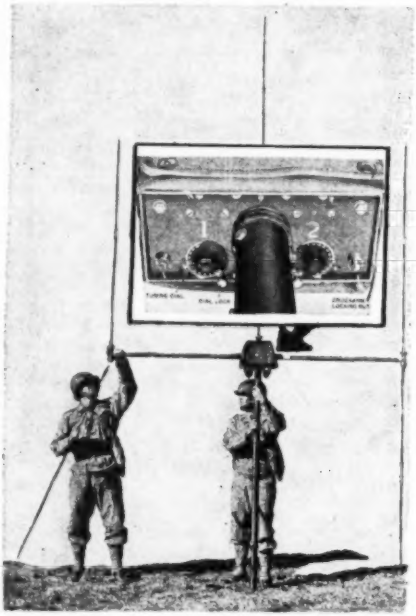

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TELEMARINE discovered this outstanding 3-Element Adcock Type Beam Antenna in Army Surplus. It includes a vertical dipole and phase-load tuning box, which permits tuning and phasing in the radiator and director elements, and phasing out the reflector element so that an unusually high front-to-back ratio results along with exceptionally high forward gain. Plug-in inductors permits use of this antenna over a frequency range of 20 to 40.0 MC. Operates with 52 or 72 ohm transmission line. Sturdy, weather-resistant construction! Operates satisfactorily with CDR-AR-22 Beam Rotator, or equivalent. New-Unused, with Instruction Book which covers complete equipment for which antenna was intended, but provides full installation and tuning-up data. Net wt. of beam 39.5 lbs. Shpg. wt. 162 lbs. Supplied with 2 plug-in inductors to cover 25-30 MC, installed in phase-load box. **COILS, PER PAIR** (2 required) for 20-22.5 to 25.0 MC; or 30-40 MC., specify freq. **$4.95**

MALLORY VIBRAPACK, TYPE 6369, 12.0V, DC INPUT, output 275 at 85ma., or 250V, at 100 ma. Uses Synchronous Vibrator, no tubes necessary. Vibrator plug polarized for positive or negative ground. Dim. 5½" deep, 2¾" wide, 6" high. "Used—good" tested condition. Shpg. wt. 8 lbs. **PRICE, EACH** **$6.95**

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PREMAX TELESCOPIC VERTICAL ANTENNA, Chromed Monel Metal, 3 telescoping sections with watertight collet-type chucks to lock each section at desired length. Extends from 6 ft. 9 inches to a maximum of 19 ft. Excellent for Marine, Ham, CB, or Base short-wave operation. NEW-UNUSED units. Shpg. 12 lbs. Originally price at over $90.00. Our **PRICE ONLY** **$14.45**

30 MC MOTOROLA COAXIAL ANTENNA. Heavy duty, high-power construction. Easily modified by reducing length of upper whip section for higher frequencies, or increasing length by a few inches for CB application. Present length of top radiator 102". Equipped with female receptacle for PL-259 coax connector and 50 ohm line. Important mounting hardware included. UNUSED Units. Shpg. wt. 130 lbs. **PRICE EACH** **$14.95**

WALKIE-TALKIE

MODEL "MAB" is a Navy Walkie-Talkie which provides single-channel, crystal-controlled reception and transmission (AM) between 2.0 and 4.5 MC. Receiver uses miniature tubes in a **superheterodyne circuit** for maximum sensitivity and selectivity. Transmitter employs miniature tubes in a crystal-controlled oscillator (1T4), a 3B4 RF Power Amplifier which will deliver from 200 to 250 milliwatts RF power to the antenna (can be souped up), and a 3B4 Heising (plate) Modulator stage. 7 tubes total in trans-receiver. Unit is housed in a water-tight bakelite case, 7⅛"H. x 10"W. x 3-9/16"D. **RANGE 1 MILE OR BETTER,** depending on location and condition. Requires 135 volts "B" and 1½ volts "A" batteries. Excellent for 75 meter Ham, CD, Fire Dep't, emergency marine, or conversion to other uses. Supplied Complete with all tubes, r'e'ving & s'mitting crystals (sorry, we cannot accept orders for a specified frequency. Crystals are FT-243 type, and can be easily changed), telescope antenna with adjustable loading coil, headphones, microphone, and canvas carrying case with straps. In Almost-New condition but not-tested at this price. Shpg. wt. per set 15 lbs. **EACH** ..... **as described, only $12.95**
PER PAIR ..... **2 Complete Sets, as above $24.50**
MODEL DAV is a Navy Walkie-Talkie, same as above, but with Direction Finding Loop within so that receiver section may be used for D.F. or Homing on the crystal-controlled receiving frequency. Same transmitter as outlined above for Walkie-Talkie use with supplied adjustable telescopic antenna. Encased in watertight, sturdy plywood case, slightly larger than above. Shpg. wt. Complete with accessories as for MAB. 20 lbs.
EACH, AS NEW—but not tested at this low price **$16.95**
INSTRUCTION BOOK FOR MAB OR DAV
only with purchase of units ..... **$ 1.00**
MINIATURE VIBRATOR PACK FOR MAB OR DAV, eliminates nuisance and expense of dry batteries. Operates from miniature 6 volt storage battery, not supplied, available from many surplus dealers. With Instruction Book. Shpg. wt. 5 lbs. UNUSED. **EACH** **$7.95**

FM MOBILE BARGAINS, FOR SPECIALISTS

GE MOBILE FM, 152-172 MC, Model ES-12A3, 15 Watts Output. Combination Transmitter Receiver, with built-in rugged 12.0 Volt DC Power Supply. Double conversion Superhet Receiver circuit, ideal for FM monitoring of hi-band FM transmissions. Used-Excellent condition, with all tubes, but less accessories. Shpg. wt. 50 lbs. **PRICE, ONLY** **$39.50**
COMCO FM, 152-172 MC MOBILE UNIT. Transmitter-Receiver and 6.0 Volt Power Supply in one housing. Single channel, crystal-controlled. Excellent for conversion to 110V. AC operation, for monitor application. Used-Very Good condition, with all tubes, but less accessories. Shpg. wt. 50 lbs. **PRICE, ONLY** **$37.50**
PHILCO 30-40 MC FM MOBILE TRANSMITTER, Model PRT-336T. Single-channel, crystal-controlled, with built-in 6.0 Volt Dynamotor Power Supply output of which is 600 volts at 175 ma. Excellent for conversion for Ham, CB, Emergency application and others. Used-Good condition, with tubes, but less accessories. **BARGAIN PRICE, ONLY** **$14.95**
PHILCO 30-40 MC FM RECEIVER, Model PRT-336. Single-channel crystal-controlled. Easily changed to 110V. AC operation, and will make an excellent, inexpensive monitor of Low-Band FM transmissions. Used-Good condition units, with tubes but less accessories. Shpg. wt. 35 lbs. **PRICE, ONLY** **$15.95**
RCA MODEL CTR-1A, FM TRANSMITTER-RECEIVER, 152-174MC. Ideal Base Station FM Monitor on "high-band." Has self contained loudspeaker, 110V AC Power Supply, Squelch & Volume Controls. Transmitter has 15kc deviation which can be modified to meet new FCC requirements. Power Output 15 watts. Receiver is double-conversion superhet. Single-Channel operation, "Used—Clean" Condition, with tubes and schematic diagram. Shpg. wt. 60 lbs. Not tested at the low price of **EACH** **$44.50**

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55 ft. 2 conductor shielded cable. Grey plastic covered. Good buy with P304ECT plug on the end. **$1.95**

1 RPM Hayden motor. 110 volt. Useful for a thousand projects. **$1.69**

100' twisted pair #24 insulated. Perfect for telephone extensions, etc. ..... **Roll 79c**

Fisher power transformer. 400-0-400 v at 100 ma. 6.3 v at 4 amps, 5 v at 3 amps. Potted. Fisher #T557-123C. 4½ H x 4 W x 3½ D. Close out. **$3.49**

New production coaxial plugs and jacks. SO-239 and BL259, **49c each.** T connector **$1.49** RG-58 reducer **18c** Double male coaxial connector **$1.00**

Double female coaxial connector **$1.00**
Telephone repeating amplifier. Contains 2 bridging transformers for balancing line. 600 ohms in, 600 ohms out. Perfect for phone patch. Unit was described in CQ June 62 article. **$1.95**

High quality ceramic mike designed for mobile. Made by Euphonics. Comes with coiled cord and double pole double throw switch. **$6.95**

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4" speaker. 8 ohms. Good quality **$1.00**

5U4 Plug-in silicon replacement. Safe up to 1000 volts working. **$2.95**

5R4 Plug-in silicon replacement **$4.95**

1000 PIV 1½ amp diode ..... **60c each, 10 for $5**

600 PIV 1 amp diode. ..... **35c, 3 for $1**

Adjustable RF choke. Slug tuned. 300 to 500 millihenry. Useful in teletype filter circuits. **97c**

Fisher output transformer. 35 watts. Hi Fi. 6600 ohm plate to plate primary. 4-8-16 ohm output. Exact replacement for Fisher 400. Schematic of amplifier included. ..... **$4.95 each, 2 for $9.50**

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60 600 to 8800 volt, 1½ amp diodes with 60 condensors and resistors for full wave rectifier. For power supplies up to 4000 volts DC. Get on the bandwagon. Eliminate rectifier tubes forever. Complete kit $24.95

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Telephone type relay one SPST NO. one SPDT. 12 volts DC. **$1.00**

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100 ohms 25 watt Clarostat power pot **$1.00**

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For use with RG8U Etc—5 ohm—75DB Attenuation or more above 54mc Insertion loss less than .25DB 4 section filter, END Sections 'M' Derived will handle upup to ONE Gallon of R.F. Terminates in two SO239 conectors in & out.
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Full Description Back of ARRL HANDBOOK

Amperite delay relays. 110 volt normally open; 2 second delay ..... **$1.00 each**

Cardboard tubular condensers, leads out bottom .245 mfd 475 volts. Use 'em in series for hi voltage supplies. A very popular item ..... **$.79 each**

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Double AC outlet mounted on standard plate for gem box. ..... **4 for a buck**

4 Prong socket for 866 or similar bases. Similar to Johnson 210 sockets ..... **2 for a buck**

Cambridge Thermionic—¼" coil form. Ceramic slug tuned ..... **3 for $1.00**

2 station transistorized intercom; uses 9 volt battery. Has oscillator tone annunicator. Good quality **$9.95 per pair**

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4" square meter center. Zero—1000 microamps each side of zero ..... **$6.00 each**

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Good quality desk mike stand with extension tube. Heavy bakelite base. Has 2 adaptors for most popular mikes **$3.95**

6 volt vibrator transformer. 300 volts DC @ 100 ma. **$1.95**

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AN/GRC: 3,4,5,6,7,8,10,19,26,46
RT-66,67,68,70

AM-65/GR	T-368/URT
PP-109/GR	BC-610E,F,G,H,I
PP-112/GR	RT-196/PRC-6
R-108/GRC	RT-174A/PRC-8
R-109/GRC	RT-175A/PRC-9
R-110/GRC	RT-176A/PRC-10
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SG-2A/GRM-4	TS-##330	TS-683
SG-13/ARN	TS-403A/U	AN/URM-80,81
MD-83/ARN	TS-497A,B	SG-17
SG-12/URM-48	SG-66/ARM-5	TS-710
AN/UPM-98,99	TS-352	TS-505D/U
AN/UPM-4A	ME-11	AN/URM-43
AN/USM-26	TS-621/URM-52	TS-323
TS-251/UP	TS-382/U	AN/PRM-10
TS-419/U	SG-15	TS-140
TS-174/U	AN/URM-32	TV-7D/U
TV-2/U	TV-10/U	TS-723/U
AN/ARM-22	AN/ARM-25	AN/ARM-51
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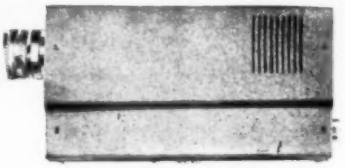

SPECIFICATION

Pick-up Tube	Vidicon Tube 7038(H)
Scanning	Random Interlace
Horizontal Frequency	15.75 KC
Vertical Frequency	50/60cps. Power line lock
Video Amplifier Frequency Response	4 5MC
Output Signal	Composite Video
Output Load Impedance	75 ohms
Output Level	1.5V peak-to-peak (Video)
Resolution	120db when modulated to RF (300 ohms) with Maching Box
Illumination	H : 450 lines at center V : 430 lines at center
Automatic Light Level Compensator	Standard 500 lux, Min. 20 lux 1:15 (20 to 1.000 lux)
Ambient Temperature	32-104°F
Power voltage	117V/AC 50/60cps
Power Consumption	12.5VA
Lens	F 1.4, 25mm C mount
Weight	6.5lb
Width	4 inch
Depth	12 inch
Height	6 inch

VIDEO and R.F. OUTPUT

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- Property Protection
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TYPE MC72 BLILEY 186.30KC ..... .90

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TV COLOR CRYSTAL 3579.545 KC ..... .98

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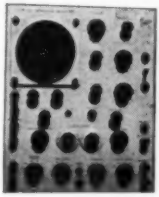

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Tektronix	513D	300.00	250.00
Tektronix	514D	275.00	225.00
Tektronix	W de band Pre-amp.		55.00
Dumont	304A	100.00	85.00
Dumont	304H		75.00
Dumont	333 Dual Beam Scope		300.00
Waterman	S-15-A Twin tube pocket scope		65.00

V. T. V. M.

Hycon	614	AC, DC, Ohms, 1.5-1500 volts	60.00
General Radio	1800B	AC, DC, 0.5-150 volts	110.00
General Radio	1803A	AC, 1.5-150 volts	75.00
Millivac	MV-17c	DC, 1 mv-1000 volts	75.00
Measurement Corp.	62	AC, DC 1-100 volts	35.00
Ballantine	300	AC, 0.01-100 volts	50.00

PULSE GENERATOR

		PULSE WIDTH	
Teletronics Lab.	PG-200AA	1-50 usec	150.00
Hewlett Packard	212A	0.07-10 usec	200.00
Measurements Corp.	79B	0.5-60 usec	60.00
Dumont	404	0.05-105 usec	200.00
Electro Pulse	3450B	0.1-10,000 usec	99.00

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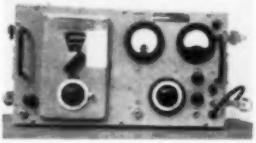

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Lambda	C-281M	125-325V, 0-200 ma	60.00
Lambda	C-481M	125-325V, 0-400 ma	95.00
Electronic Measurements Model	235AM	Programmable, 0-600V, 0-500 ma	$225.00
	234AM	Programmable, 0-300V, 0-500 ma	$125.00
	231AM	Programmable, 0-300V, 0-100 ma	$ 80.00
	204AB	Gen. purp., 0-500V, 0-300 ma	$100.00

EXTRAS

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Kay Electric	240B Mega Node 5-220 Mc noise generator	125.00
Non Linear System	V-35 Digital Volt Meter with 125B AC, DC Converter, 5 digits ± 999.99	750.00

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If your **WANTS** inquiry drops into a slot unmatched in the other 2 files, chances are that tomorrow it will be matched by a new card in one of the others.

• TO SELL YOUR Surplus Electronics . . . . . .

SO if you **HAVE MATERIAL,** surplus to your needs, or want to update, tell us about it and price it or negotiate with us or, if necessary, ask us to bid.

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Add $65.00 for **975-2200 mc.** Add $125.00 for **2175-4000 mc.** Add $30.00 for **AM/FM** 60 cy.	
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(Use Handbooks TM11-352 & -2222)	
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H.P. 608A hi-pwr sig. gen., .05-65 mc.	**P.U.R.**
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More Letters

Dear Wayne:

I suppose I'm what you would call an old-timer among hams. Whenever possible I've built most of my own gear in the past; and I still do. To me, this means a grand part of amateur radio . . . rolling your own, experimenting with different circuits, modifying, up-dating your own station. Plus a kind word to the new ham in our midst, along with a few spare parts.

But I obviously cannot afford to pay "list price" for everything that finds it way into my shack. And so we economize, while not sacrificing quality, by utilizing "surplus" gear and parts whenever they will fit the need. I've been buying surplus from Meshna up Boston way, and Rex in New York for many years, with complete satisfaction.

But we find that the "official" publication of the hams won't take ads from these people . . . despite their favorable reputation. And it becomes quite obvious that subscribers to that magazine are being diverted from buying what they want, because of this selective policy. No ads from the "surplus houses" are allowed, but you can bet your boots that there are plenty for ready-made equipment.

But when the managers of this staid journal paid money—real money, an exceptional occasion—to writers and one man lambasted the art of do-it-yourself, while no one presented the opposite side of the coin, this caused me to stop and think: where are we drifting? Or better stated: where are these managers trying to manipulate us??

It would seem toward the realm of buy-it, plug it in, and yak it up. Should this continue unchanged, we amateurs will have no more respect from the regulatory authorities than the citizen-band operators, and justifiably so. This is one aspect of amateur radio that I would certainly like to see revived and revitalized: the gentle art of make-it-yourself! Even when you fail in a project of this nature, you must learn something. And when you do make it, there is a terrific sense of pride in completion of your own work.

Keep up the steady stream of thoughtful articles that you have been providing. I find your magazine most helpful and informative in matters of this nature. It often furnishes a ray of hope in an otherwise somber picture. The arrival of 73 each and every month is an appreciated event at the W2OLU ham-shack.

Neil Johnson W2OLU

Dear Wayne,

I read with interest the excellent and informative article by K2ICF/6 on the double Hula hoop antenna. It didn't take long for somebody to realize that the ground plane could be eliminated in this way. There are a couple of points which may contribute to an even better version of this antenna, and I'd like to put in my nickel's worth.

In feeding this antenna, if one uses an open wire tuned feed system (a la Zepp antenna) connected to the ends of the hoops, two major advantages will appear.

1. Resonating the ring will now be a matter of tuning a coupling circuit which can be located inside the shack, so easy QSY becomes possible.

2. Because the tuned feed system can reflect an inductive as well as a capacitive load across the ends of the antenna, it no longer becomes necessary to cut the loops for the high end of the band, as with capacitive tuning alone. Possible operation on harmonic frequencies, and certainly operation on frequencies where the circumference of the hoops exceeds a quarter wave should be practical, and perhaps very interesting.

Best regards,
Henry S. Keen W2CTK

Dear Wayne:

On page 15 of May 73 magazine, how does the receiver work without an antenna? HI. May I suggest removing the antenna lead from the first terminal down and connecting it to fourth terminal down.

Cliff Rowe W2CTH

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Northern Radio Frequency Shift

Converter Type 152.

Sold less frequency determining network. You can use standard 88 MH toroids. Complete with tubes & power supply for Loop. Input 110/1/60cps. Size: 3½ x 8½. With conversion info. Ex. Cond. **$39.95**

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100-156 mc.
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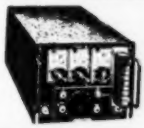

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2-18 mc. 100 watts AM-CW.
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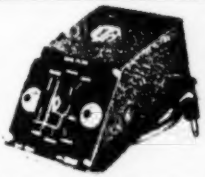

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NORTHEAST OHIO VHF hamfest Sunday Jun 20th at Maca Park two miles east of Tallmadge, Ohi on state route 18. Lots of prizes and contests. Contac W8JHS, W8CZV or W8IXZ for more information.

TOTAH ARC field day. June 19 and 20. Work the statio and get the 507 award. Totah ARC, P. O. Box 24 Farmington, N. M.

MID-MO ARC hamfest. June 5, Memorial Park in Jefferson City, Mo. Contact KØJJS, 1204 Edgewood Drive for more information.

TRI-STATE ARC Ham picnic, June 6 at Camden Park in Huntington, W. Va.

CLARK COUNTY hamfest. June 13 at the Clark Co. State Forest near Henryville, Indiana.

NATIONAL CAPITAL VHF Hamfest, May 23rd at Marshall Hall Park in Charles County, Md.

CLINTON COUNTY VHF hamfest. June 13 at Shady Acres Ranch near Frankfort, Ind. Contact W9URS for more information.

BREEZESHOOTERS HAMFEST. May 23 at West View Park near Pittsburgh, Pa.
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SAN FERNANDO VALLEY RADIO CLUB, W6SD, 5th Annual Hamfest-Picnic, July 11. Sunset Farms, 16303 Foothill Blvd., San Fernando. Free Prizes, swimming, displays. Write for info; WB6GZZ, c/o Box 3151, Van Nuys, Calif. 91407.

AWQCWA will hold its annual summer meeting in Seattle this year on June 12 and 13, at the Lakeshore Inn Motel. All old timers, whether members or not, will be welcome. For further information and reservations contact W. P. Gilbert W7QA, 4060 S. Myrtle St., Seattle, Washington, 98118.

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- 417A Converter for 2
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- Design of VHF Tank Circuits
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TUBES 4CX250B (7) @ $35; 417A (10) @ $3; 7077 (10) @ $10; 6C21 $10; GL6442 (2) @ $20; Johnson Mobile $30. Tubes new. Getting married and have to forget VHF KW. K1GBF, Box 485, Manchester, Vermont.

73 Books

Peterborough, N.H.

1—CARE AND FEEDING OF HAM CLUBS—K9AMD.—Carole did a thorough research job on over a hundred ham clubs to find out what aspects went to make them successful and what seemed to lead to their demise. This book tells all and will be invaluable to all club officers or anyone interested in forming a successful ham club. **$1.00**

—SIMPLIFIED MATH FOR THE HAM—ACK—K8LFI.—This is the simplest and easiest to fathom explanation of ham's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of understanding basic math our kids would have a lot less trouble. **50c**

—REVISED INDEX TO SURPLUS—4WKM.—This is a complete list of every article ever published on the conversion of surplus equipment. Gives a brief rundown on the article and source. Complete to date. **$1.50**

—SURPLUS TV SCHEMATICS.—You can save a lot of building time in TV if you take advantage of the real bargains in surplus. This book gives the circuit diagrams and info on the popularly available surplus TV gear. **$1.00**

7—AN/ARC-2 CONVERSION.—This transceiver sells in the surplus market for from $40 to $50 and is easily converted into a fine little ham transceiver. Covers 2-9 mc (160-80-75-40 meters). This booklet gives you the complete schematics and detailed conversion instructions. **$1.00**

12—CW—W6SFM.—Anyone can learn the code. This book, by an expert, lays in a good foundation for later high speed CW ability. **50c**

14—MICKEY MIKER—WØOPA.—Complete instructions for building a simple precision capacity tester. Illustrated. **50c**

15—FREQUENCY MEASURING—WØHKF—Ever want to set yourself up to measure frequency right down to the gnat's eyebrow? An expert lets you in on all of the secrets. Join Bob high up on the list of Frequency Measuring Test winners. **$1.00**

RECEIVERS. K5JKX.—If you want to build a receiver or to really understand your receiver, this is the book for you. It covers every aspect of receiving in author Kyles usual thorough manner. **$2.00**

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TEST EQUIPMENT HANDBOOK. W6VAT.—Every ham needs to have and know how to use test equipment. This book tells you how to make valuable ham test gear easily and cheaply. It also covers the use of test equipment. **50c**

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Credit to Dr. Robert L. Carrel for his "Analysis and Design of the Log-Periodic Dipole Antenna" was inadvertently omitted in the article "Design of Log-Periodic Antennas" by VE3AHU in the May issue of 73. Our apologies to Dr. Carrel.

A few errors in the article "2m Beer Can Cavities" by WA2INM in the May issue: First, the article's title is a bit off base and part of the text is irrevelant. The circuits described are coaxial circuits, not cavities. Also, point X referred to in the text is the link on coil L3. Point Y is the antenna input. Place the trimmer referred to in series with the antenna.

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INDEX TO ADVERTISERS

Alco, 105, 122
Algeradio, 109
Alltronics-Howard, 122
Atlantic, 110
Amco, April 65
American Crystal, 122
Amperex, May 65
Amrad, 122
Arrow Sales, 106
ATV Research, 50
Autronics, 51
Aztec, Jan. 65
Babcock, April 65
BC Electronics, 91
Big D Hamfest, 76
Budwig, 81
Burghardt, 77
B & W, Mar. 65
Callbook, 71
C & H, 104
Christie, 122
Columbia, 100, 121
Communication, 96
Cornell-Dubilier, Jan. 65
Cubex, Jan. 65
Cusberaft, 49
Datak, May 65
Davro, 29
DeMambro, 89
Denver Crystals, May 65
Dow Key, 21
Dow Trading, 102
Drake, Cover II
Editors & Engineer, May 65
Edwards, 86, 87
Electronic Comp., 124
Ell-Conn, 57
Epsilon, May 65
Evans, 90
Fair, 122
Fichter, May 65
Finney, April 65
FM, 102
Fulton, April 65
Gain, May 65
Galaxy, Cover III, 128
Gem Electronics, Feb. 65
Gift Shop, 98
G & G, Feb. 65
Glass, J. J., 112
Gonset, Feb. 65
Goodheart, 120
Government Wkse., 97
Graham Radio, May 65
Hammarlund, 3
Hayden, 93
Heath, 12
HCJ, May 65
Heffron, 119
Henry, 69
Hill, Feb. 65
Hi-Par, May 65
Hy Gain, 25
Int. Crystal, 4
Invertronics, 90
Irving, May 65
Jefftronics, 108
Juge, Mar. 65
Linear Systems, Mar. 65
Mann, 122
Master Mobile, April 65
McCoy, May 65
Metro, 115
Meshna, 94
Mission, 83
Mor-Gain, 54
Mosley, 17
National, Cover IV
Newtronics, 39
Parks, 90
Path, April 65
Poly-Paks, 92
Portage, 123
Quaker, 101
Quement, 53, 55, 57, 59
Reyco, Mar. 65
Rex, 111
Rohn, 7
RSGB Books, 124
RW Electronics, 85
Saich, 51
Scientific Asc., 55
Selectronics, 98
Sideband Engineers, April 65
Skylane, 57
Slep, 116
Space, 117
Spera, 118
Sprague, 47
Sterman, April 65
Swan, 30, 37, 64
T A R, 127
Telrex, 35, 67, 75
Telemarine, 114
Texas Crystal, 24
Transcom, 27
Transistors Ult., Mar. 65
Tri-Ex, April 65
United Plastic Mold, 123
U. T. C., May 65
Vanbar, 85
Vanguard, 73
VHF Antenna Book, 42
Viking, Mar. 65
Waters, 9
Western (Calif.), May 63
Western (Neb.), 81
Wilson, 122
World Radio Labs, 128, Cover III
73 Books, 125
73 Hamfest, 43
73 Subscriptions, 126

Propagation Chart

June 1965

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EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	14	14	14	14	14
ARGENTINA	14	14	14	7	7	7*	14	14	14	14	21	21
AUSTRALIA	14	14	14*	7*	7	7	7	7	7	7*	14*	14
CANAL ZONE	14	14	14	7*	7	7	14	14	14	14	14	21
ENGLAND	14	7	7	7	7	14	14	14	14	14	14	14
HAWAII	14	14	14	7*	7	7	7	7*	14	14	14	14
INDIA	14	14*	7*	7*	7*	14	14	14	14	14	14	14
JAPAN	14	14	7*	7*	7	7	7	14	14	14*	14*	14
MEXICO	14	14	14	7	7	7	14	14	14	14	14	14
PHILIPPINES	14	14*	7*	7*	7	7	14	14	14	14	14*	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7*	7*	7*	14	14	14	14	14	14*	7*
U. S. S. R.	14*	7	7	7	7	14	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7*	7	7	7	14	14	14	14	14
ARGENTINA	14	14	14	7	7	7*	14	14	14	14*	14	14
AUSTRALIA	14	14	14	14*	7	7	7	7	7	7*	14*	14
CANAL ZONE	14*	14	14	14	7	7	14	14	14	14	14	21
ENGLAND	14	7	7	7	7	7*	14	14	14	14	14	14
HAWAII	14	14	14	14	7	7	7	7*	14	14	14	14
INDIA	14	14*	7*	7*	7*	7*	7*	14	14	14	14	14
JAPAN	14	14	14*	7*	7	7	7	14	14	14*	14*	14
MEXICO	14	14	7*	7	7	7	7	7	7*	14	14	14
PHILIPPINES	14	14	14*	7*	7	7	7	14	14	14	14*	14
PUERTO RICO	14	14	7*	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7*	7*	7*	14	14	14	14	14	14*	7*
U. S. S. R.	14*	7*	7	7	7	7*	14	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	14	14	7	7	7	7	7*	14	14	14
ARGENTINA	14	14	14	7	7	7	7*	14	14	14	21	21
AUSTRALIA	14*	14*	14*	14	14	7	7	7	7	7*	14	14*
CANAL ZONE	21	14	14	14	7*	7	7*	14	14	14	14	14*
ENGLAND	14*	7*	7	7	7	7	7	14	14	14	14	14
HAWAII	14	14*	21	14	14	14	7	7	14	14	14	14
INDIA	14	14	14	14*	7*	7*	7*	14	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	14	14*	14*	14
MEXICO	14	14	14	7	7	7	7	7	7*	14	14	14
PHILIPPINES	14	14	14	14*	7	7	7	7	14	14	14*	14
PUERTO RICO	14	14	14	14	7*	7	7*	14	14	14	14	14
SOUTH AFRICA	7	7*	7*	7*	7*	7*	7*	14	14	14	14*	7
U. S. S. R.	14*	7*	7	7	7	7	7*	14*	14	14	14	14
EAST COAST	14	14	14	7	7	7	7	14	14	14	14	14

Very difficult circuit this hour.

* Next higher frequency may be useful this hour.

Good: 2, 14-19, 21-25, 27-29

Fair: 2, 4, 5, 7-9, 12, 13, 20, 30

Poor: 3, 6, 10, 11, 26

VHF DX: 5, 6, 13-16, 24

"TAB" • TRANSISTORS • DIODES!!
GTD! FACTORY TESTED — FULL LEADS.

PNP 100Watt/15 Amp HiPower TO36 Case! 2N441, 442, 277, 278, DS501 up to 50 Volts/ VCBO $1.25 @. 5 for $5. 2N278, 443, 174 up to 80V $3 @, 2 for $5.

PNP 30 Watt, 2N155, 156, 235, 242, 254, 255, 256, 257, 301, 392, @ 35c, 4 for $1
PNP 2N670/300Mw 35c @. 4 for $1
PNP 2N671/1Watt 50c @. 3 for $1

PNP 25W/TO 2N538, 539, 540, 2 for $1
2N1088 6/$1, 1039 4/$1, 1040 $1
PNP/TO5 SIGNAL 350Mw 25c @, 5/$1
NPN/TO5 SIGNAL IF, RF, OSC 25c @. 6 for $1

Silicon PNP/TO5 & TO18 25c @. 5 for $1
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TO36, TO3, TO10 Mica Mtg 30c @. 4/$1
Diode Power Stud Mica Mtg 30c @. 4/$1

ZENERS 1Watt 6 to 200v 70c @. 3/$2
ZENERS 10Watt 6 to 150v $1.45 @. 4/$5
ZENER Kit Asstd up to 10w 3 for $1
STABISTORS up to 1watt 5 for $1

TRANSISTORS—TOO MANY! U-TEST

Untested Pwr Diamonds/TO3 10 for $1
Untested TO36 up to 100Watts 3 for $1
Untested TO5/SIGNAL/sistors, 20 for $1
Untested Power Diodes 35 Amp 4 for $1
Untested Pwr Studs up to 12Amp 12 for $1

D.C. Power Supply 115v/60 to 800 Cys. Output $30 : Tap 165V up to 150Ma, Cased $5@. 2 for $9

SILICON POWER DIODES • STUDS

DC AMP	50Piv 35Rms	100Piv 70Rms	150Piv 105Rms	200Piv 140Rms
3	.08	.14	.17	.24
12	.30	.55	.70	.85
18*	.20	.30	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	6.75

DC AMP	300Piv 210Rms	400Piv 280Rms	500Piv 350Rms	600Piv 420Rms
3	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.35
100	5.75	4.60	5.50	8.00
240	11.70	17.10	23.94	29.70

*P.F. PRESS-FIT AUTOMOTIVE TYPE!

18 Amp Press Fit up to 200Piv 4/$1
2 to 3 Amp Studs up to 600Piv 6/$1
35 Amp Studs 150 to 200Piv 5 for $5

"TAB" • SILICON 750MA DIODES
NEWEST TYPE! LOW LEAKAGE

Piv/Rms 50/35 .05	Piv/Rms 100/70 .09	Piv/Rms 200/140 .12	Piv/Rms 300/210 .14
Piv/Rms 400/280 .15	Piv/Rms 500/350 .19	Piv/Rms 600/420 .23	Piv/Rms 700/490 .27
Piv/Rms 800/560 .35	Piv/Rms 900/630 .45	Piv/Rms 1000/700 .65	Piv/Rms 1100/770 .75

GTD ALL TESTS AC/DC & LOAD!

1700 Piv/1200 Rms/750 Ma/$1.20 @. 10/$10
Same 1100 Piv/770 Rms 75c @. 16/$11
3 Kv/2100 Rms/200 Ma/$1.80 @. 6/$10
6 Kv/4200 Rms/200 Ma/$4 @. 3/$9
12 KV/8400 Rms/200 Ma $8 @. 2/$14

SCR—SILICON CONTROL RECTIFIERS!

PRV	7A	16A	PRV	7A	16A
25	.60	1.00	200	2.70	3.00
50	1.00	1.35	300	3.00	3.45
100	1.60	2.15	400	3.75	3.90
150	1.95	2.45	500	4.75	4.80
200	2.20	2.80	600	5.45	5.65

UNTESTED "SCR" Up to 25 Amps, 6/$2
Glass Diodes IN34, 48, 60, 64, 20 for $1

Two RCA 2N408 & Two Regulators RCA IN2326 on prtd ckt. 30c @, 4/$1

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4-125A	15.00	826	Query	5R4WGA	3.50
4-400A	35.00	829B	7.20	24G	Query
4-1000A	75.00	872A	3.50		
		0A2	.65		

We Swap Tubes! What Do/U Have?

0A3	.80	5R4	1.00	6F7	.99
0C3	.70	5T4	.90	6F8	1.30
0D3	.59	5V4	.89	6H6	.59
0Z4	.79	5Z3	.89	6J5	.59
1L4	.82	6A7	1.00	6J6	.59
1R4	5/$1	6A8	.99	6K6	.59
1S4	.78	6AB4	.59	6L6	1.19
1S5	.68	6AC7	.72	6SN7	.72

Send 25c for Catalog!

1T4	.85	6AG5	.65	6V6GT	.90
1T5	.95	6AG7	.75	12AU7	.68
1U4	6/$1	6AK5	.69	12A6	.45
1U5	.75	6AL5	.55	25L6	.72
2C39A	Q	6AQ5	.66	25T	4.00
2C40	5.50	6AR6	1.95	28D7	.89
2C43	6.50	6AS7	3.49	50L6	.59
2C51	2.00	6AT6	2/$1	83V	.95

We Buy!		We Sell!		We Trade!	
2D21	.65	6BA6	.59	250TL	19.45
2K25	9.75	6BE6	.59	VR92	5/$1
2K26	30.00	6BK7	.99	388A	3/$1
2V3	2/$1	6BQ6	1.19	416B	16.00
2X2	.48	6BY5	1.19	450TL	43.00
4X250B	30.00	6BZ6	.91	813	9.95
5BP4	7.95	6C4	.45	815	1.75

Top $$$ Paid for All Tubes!

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866A Xfmr 2.5V/10A/10Kv/Insl $3 @
Ballentine ±300 AC/Lab Mtr. $54
(Sd) Choke 4Hy/0.5A/27Ω $40 @. 2/$6
"VARIACS" L/N 0-135v/7.5A $15
"VARIACS" L/N 0-135v/3A $10
TWO 866A's & Fil. Xfmr. $6

SILICON TUBE REPLACEMENTS

OZ4	UNIVERSAL	$1.75 @. 2/$3
5U4	120Rms/160OInv	$2 @. 5/$5
5R4	1900Rms/2800Inv	$9 @. 2/$15
866	5Kv/Rms - 10.4Kv Inv	$11 @. 2/$20

Mica Condsr .006 @ 2500V 4/$1
Snoopserscope Tube 2" $5 @. 2/$9
Mini-Fan 6 or 12Vac/60Cys $2 @. 3/$5
4X150 Ceramic Loktal $1.25 @. 2/$2
Line Filter
Line Filter 50Amp/250VAC $10 @. 2/$16

DC 3½"/Meter/RD/800Ma $4 @. 2/$7
DC 2½" Meter/RD/100Ma $3 @
DC 2½" Meter/RD/30VDC $3 @. 2/$5
AC 3½" Meter/RD/130VOC $5 @. 2/$9
DC 4" Meter/RD/1Ma/$5 @. 2/$9

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Line Filter 4.5A @ 115VAC 4 for $1
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Kit 10 Inslid Tuning Tools
Kit 6 "SunCells" Battys
Kit 10 Sub-Min Tubes
Kit 12 Alligator Clips Asstd
Kit (6) Tube Clamps Asstd
Kit (12) 1Amp Silicon Rectifiers
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Kit 35 Precision Resistors
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Kit 12 Electrolytic Cond's.
Kit 65 Tubular Condensers
Kit 500 Lugs & Eyelets
Kit 10 Bathtub Oil Cond's.
Kit 5 Ibs. Surprise Package
Kit 8 Phono/Patch XMmtrs
Kit 10 Inslid Tuning Tools
Kit 6 "SunCells" Battys
Kit 10 Sub-Min Tubes
Kit 12 Alligator Clips Asstd
Kit (6) Tube Clamps Asstd
Kit (12) 1Amp Silicon Rectifiers
Kit (12) 2Amp Stud Rectifiers

Kit 75 Mica Condensers
Kit 25 Resistors 1/2/1&2W
Kit 200ft Hook Up Wire
Kit 5 FT243 Xtal Holders
Kit 4 Rolls, 500ft/ea. Assorted Color
Kit 10 Xtal Dlcs. & Blanks
Kit 4 Asstd Rectifiers
Kit 100 Self/Tap Screws
Kit 100 Asstd Hdwe. Nuts & Cut
Kit Hi Gain Xtal Mtls.
Kit 2 pair 50239 & PL59
Kit 12 Binding Posts Asstd
Kit (5) TO56/50Watt Untested
Kit (50) TOPHAT 3/4A/Diodes Untested
Kit (12) TO5/3A Transistors Untested
Kit (4) PFF/PressFit 16Amp Studs

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Socket Ceramic 1625 Tube 4/$1
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Heavy duty power supply has 115/230 VAC primary, conservative 2KW CCS rating with grain-oriented silicon steel core, solid state rectifiers. All cables supplied. Power supply can be placed under desk for operating convenience. Protected by attractive cover.

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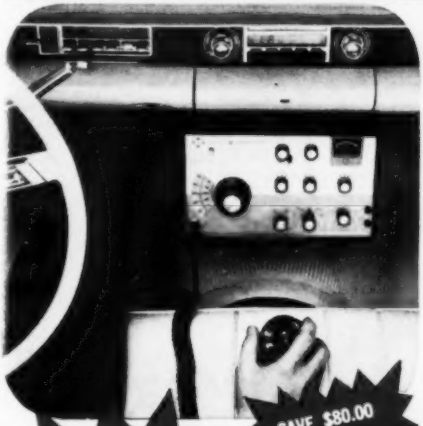

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